INDIANA
STATE TEACHERS COLLEGE

POPULAR AVIATION

Combined with Practical Mechanics; Including Aeronautics and Aviation Stories and Mechanics

A MAGAZINE FOR THE PROMOTION OF AMATEUR AVIATION AND PRIVATE FLYING

Volume XII | MAY, 1933 | Number 5

TABLE OF CONTENTS

Feature Articles

AN AIRY CHAT WITH THE EDITOR 276
IS THE BIPLANE SUPERIOR TO THE MODERN MONOPLANE? 278
LT. MARTINUS STENSETH — AMERICAN ACE 281
DETAILS OF THE VOUGHT "CORSAIR" 283
THE INS AND OUTS OF AERO RADIO 285
IMPORTANT CHANGES IN AIR LAWS 287
OUR PHOTO PHANATICS ALBUM 289
WHAT ABOUT THAT HOSTESS JOB? 290
SQUADRON OX-5 MAKES CONTACT 291
QUESTION AND ANSWER DEPARTMENT 292
AEROBATICS — NEW LOOPS AND ROLLS 294
46 YEARS OF AVIATION 297
PICK OUT YOUR AVIATION JOB 299
LET'S START THE BIG PUSH 301
WHAT IS THE OCTANE NUMBER 303
HOW TO BUILD THE CORBEN JUNIOR ACE 305
TEST HOPPING LIGHTPLANES 309
DREAM SHIPS BY OUR DREAMERS 310
WHAT OUR READERS ARE BUILDING 311
MODEL DEPARTMENT — BUILDING THE VOUGHT CORSAIR 313
WITH THE MODEL ENGINE BUILDERS 317
BARTER AND EXCHANGE 321

THE PICK OF THE BRIEFS

The New Full Size Capelis Plane 282
This is the "Silent Liner of the Air" 282
To Produce the Vance Flying Wing 284
Photo Phans Club 288
The Levasseur Torpedo Plane 293
"Barney's Bars" New Flyers' Custom 293
The Pistol Aircraft Camera 296
More About Aero Clubs 296
New Junkers Has Twin Rudder 300
German Air Pioneer Dead 300
The Wibault-Penhoet is a New French Trimotor 302
Details of the Short "Kent" Flying Boat 304
The Bluebird IV 308
Air Corps Develops New Heater System 308
Something About Props 311
Estimating Landing and Top Speeds 312
Build this Fokker D-VII Replica Model 318
Floaters vs. Flyers 319

POPULAR AVIATION, Volume 12, Number 5, May, 1933. Published monthly by Aeronautical Publications, Inc., at 608 South Dearborn Street, Chicago, U. S. A. William B. Ziff, Publisher; B. G. Davis, Editor; John B. Rathbun, Managing Editor. New York Office, 551 Fifth Avenue, New York City. Subscription $2.50 per year, single copies, 25 cents, foreign postage, $1.00 per year extra. Contributors are especially advised to retain copy of their contributions, which must be accompanied by return postage. All such material will be handled with reasonable care, but this magazine assumes no responsibility for their safety. Any copy accepted is subject to revision or changes to meet the requirements of this publication. Payment for copy used will be made at our current rates. Entered as second-class matter, January 24, 1933, at the Post Office, Chicago, Ill., under the act of March 3, 1879. Additional entry, Springfield, Ohio.

XUM

Is the Biplane Superior To

A flight of modern British military biplanes, indicative of this nation's firm belief in the utility of the biplane.

by
JOHN B.
RATHBUN

ABOUT every ten years, there is a sudden change in aviation styles, modes and fashions — sudden drastic changes that are followed as blindly and devotedly by the aviation world as are the yearly fashions in women's hats and gowns.

In most cases, there is no real nor logical reason for these sudden whims. Nothing radically new is ever introduced in the matter of principle or design—everything has been tried out many times before. It is just simply a switch from one old idea to another old idea by the command of the fashion leaders of the time.

This faddism is just one example of the copy-cat instinct that seems to prevail in modern engineering institutions. Just let some one hit on a popular idea and then, whether it is right or wrong, the rest of the aeronautical sheep form in line and follow the bell-wether to better or worse conclusions.

Just at present, for example, America is monoplane mad and has been for some years. With the exception of many of the Army and Navy ships, designed by men who know what they are doing, the monoplane is the predominating type in the United States. But civil aviation clings to the single-decker with all of the fatuity of a single-track mind that might be understandable in certain foreign countries but not in the ordinarily versatile U. S. A.

And now getting down to the subject of this article and neglecting for the time the causes that have led to the pre-eminence of the monoplane, it is quite interesting to note that the biplane has usually emerged triumphant after a period of monoplane boosting and propaganda. This is a matter of history which may be repeated within the next few years. The biplane has sheer points of merit which cannot be denied.

A great variety of airplane types were produced between the years 1908 and 1918, both experimental monoplanes and biplanes with but little preference for either type. This period then terminated suddenly in favor of the biplane during the last two years of the World War—for good reason—though many monoplanes had been employed during the first years of the conflict. Therefore, the biplane under the stress of war quickly edged out its single-wing opponent on the score of superior performance.

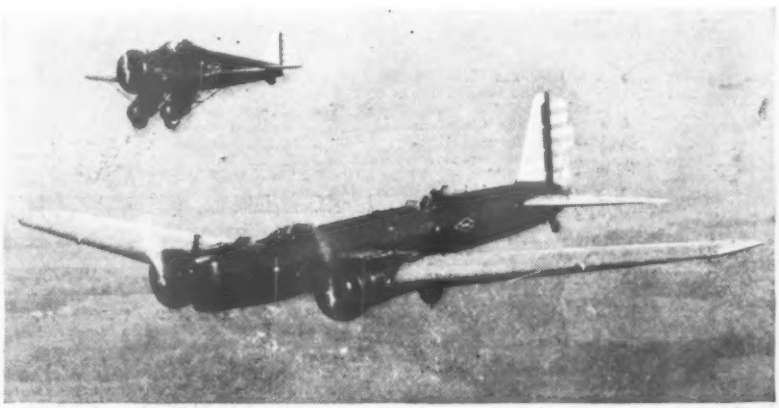
For ten years after the war, things drifted along leisurely with the biplane still in the ascendent until we arrive at the big year of Lindbergh's trans-Atlantic flight—a monoplane venture that left a deep impression on aeronautic America. Almost overnight, aero fashion decreed that the monoplane "was the thing" and since that time we have been buried under a deluge of monoplanes for no real reason at all. It is the old case of "follow the leader."

COPY-CAT designers and wild-cat manufacturers had a real feast in building replicas of the "Spirit of St. Louis" in all sizes and colors. They rode along on the publicity wave of the Lindbergh episode with its wonderful advertising and sales value and, of course, the only answer to such conditions was a monoplane that was as nearly a facsimile of Lindbergh's ship as they dared to make it.

Newcomers to aviation and unthinking bystanders were fired with the bombast and blare in the headlines of every paper and magazine of that period. They failed to recall the fact that the Atlantic had been crossed by airplanes many times before and in every case, these earlier victories had been made with biplanes!

A good nine years before the Lindbergh flight, Brown and Alcock flew across the Atlantic in a Vimy-Vickers biplane powered with Rolls-Royce liquid-cooled engines. And shortly after, came the trans-Atlantic NC-4, a biplane flying-boat with liquid-cooled Liberty engines that gave an excellent performance. Then came other biplanes on equal or even longer flights.

By various ways, including first page newspaper advertising and scare-heads, the public was educated to the idea that trans-Atlantic flights were essentially monoplane accomplishments and that the biplane was a thing of the past. Coupled with the monoplane's achievement in the public mind was



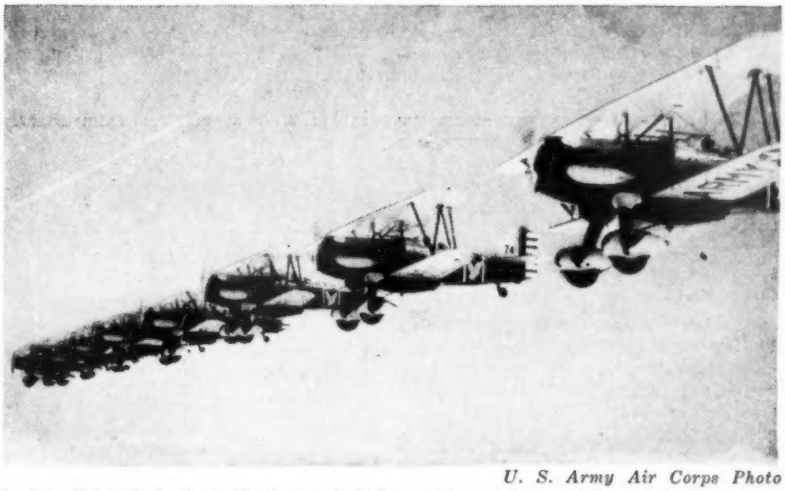
U. S. Army Air Corps Photo

A striking picture of the type of monoplanes now being experimented with by the U. S. Army Air Corps, a P-26 Boeing pursuit ship and a Boeing B-8 monoplane bomber.

INDIANA
STATE TEACHERS COLLEGE

the Modern Monoplane?

The question, Monoplane vs. Biplane, is an old, old problem which has been argued, wrangled and debated for the past twenty years. Mr. Rathbun gives his personal views in this article, and P. A. will await the bombardment from readers who will differ with him as usual.



U. S. Army Air Corps Photo

Here's a flight of the latest U. S. pursuit biplanes, the well known P-6E pursuit biplanes, of the 17th. Pursuit Squadron, Selfridge Field. This indicates an appreciation of the biplane for military service in this country.

the radial aircooled engine, which has its virtues it is true but likewise has its shortcomings.

It is significant, however, in spite of the uproar and publicity given to the monoplane and the radial air-cooled engine, that the majority of the old-timers kept right on with their biplane production and were not deceived by this outburst. With every facility close at hand for making comparative tests between the two types of planes, the Army and the Navy still hung their faith on the biplane, although, of course, they carried out experiments with monoplanes. The majority of the service machines in the U. S. Army and Navy are still biplanes and the air forces of Great Britain are of a like mind.

And most of this monoplane rumpus is based upon, what the writer believes, a false idea of efficiency. The well known fact that a monoplane wing shows less power loss in its laboratory form than a biplane wind-tunnel model has led to all sorts of false conclusions and fallacious beliefs in respect to the full size airplane wings freely flying under practical conditions.

I do not deny that there is interference between the upper and lower wings of a biplane that materially reduces the lift per square foot and which also reduces the lift-drag ratio, but I also claim that there are compensating factors in a full size airplane that offset these purely theoretical disadvantages.

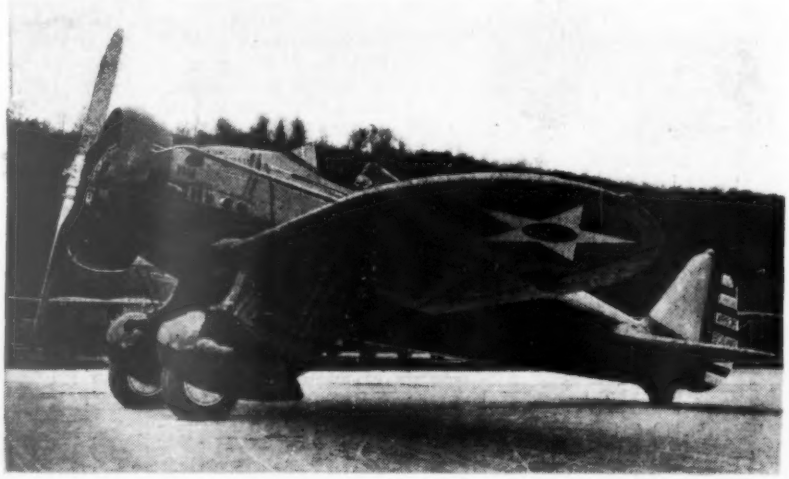
One of the most convincing demonstrations for comparing the relative power efficiencies of full size biplanes and monoplanes is to plot a power-speed graph from the performance of various modern commercial machines. If, after plotting 20 biplane values and 20 monoplane values on the curve, you can afterwards tell which are monoplanes or biplanes, then you're a better man than I am. The speed-power characteristics of modern biplanes and monoplanes follow so closely along the same line or overlap so that they can hardly be distinguished from one another.

FROM anything that you can determine from such a chart, the biplane is fully the equal of the monoplane in respect to the greatest advantage claimed by monoplane adherents. The biplane is certainly not so wasteful of power and fuel as it has been claimed, and this statement is borne out by the biplane transports employed on the long distance British airways where fuel efficiency is a paramount issue. Would biplanes be employed on the scheduled runs from London to the Orient and London to Africa if they were markedly inferior to the monoplane type?

Properly designed, with a correctly proportioned gap between the upper and lower wings, the loss by interference is not great. The great trouble comes when the wings are too close to each other so that the air-stream is unduly strangled in the gap. With the gap equal to or greater than 1.4 times the chord of the wings, there is comparatively little loss in a biplane cell. Trouble has risen in the past from making the gap equal to the chord or even shorter and also in avoiding other adjustments that should be made within the cells.

But power and fuel efficiency is not all there is to aviation. There are other things to be considered that are even more important. These items are the outstanding necessity for greater structural strength and better stability, factors which are inherently better with a biplane than with a monoplane.

From its very nature, a monoplane cantilever wing is the weakest structure possible for a given weight of material and there is no inherent tendency toward stability in a longitudinal sense with the monoplane unless freakish construction is resorted to, such as



An experimental pursuit monoplane, the XP-936 Boeing that is being tried out by the U. S. Army Air Corps. Just how it compares with the biplane has not yet been made public.

XUM

negative gull tips, exaggerated washout or similar methods.

A trussed biplane structure can be made much stronger, weight for weight, than almost any type of monoplane unless an unusual amount of external bracing is used with the latter type. The beam of a cantilever wing is shallow, only a few inches deep at the best, while the depth between the upper and lower wing beams of a biplane is measurable in feet. Then, since the strength of material subjected to bending varies as the "square of the depth," it can easily be seen that an ounce of material in a biplane spar is the equal of many times that amount placed in the shallow wing beams of a self-supporting monoplane.

And here is another very queer conception of things by the monoplane boosters. They can at once see why a self-supporting cantilever wing is possible for a monoplane but they cannot see why such a construction is equally possible for a biplane! Even though full supporting cantilever wings were always desirable—which they are not—there is no reason why this type of wing is not equally applicable to the biplane.

Of course, we understand that the wing thickness of a biplane wing is less than that of a monoplane wing of equal area by reason of its shorter chord, but at the same time our opponents fail to acknowledge that the wing of an equivalent biplane is shorter (shorter span), so that in addition to its lighter loading, the center of the load is closer to the fuselage with reduced bending moments and a much smaller spar.

And now we arrive at the point where we can tackle that old, old argument concerning head resistance that has been raised ever since the monoplane came into being. We can say, conclusively, that the present biplane with its interplane struts and stays presents very little more resistance than the average monoplane of the braced wing type because there are very few more running feet of interplane struts in the air-stream than with the bracing and landing gear of the braced monoplane structure. The fact that many of the fastest military planes in the world are of the biplane type rather bears out this fact.

A new type of biplane having cantilever wings and so heavily staggered that there is practically no interference. This is the product of the Acadamische Fliegergruppe, Darmstadt, Germany.

WHEN they bring up that old argument about the clean-cut lines of the self-supporting cantilever wing type monoplane and its low resistance, we can come back with full assurance and state that there is no reason at all why a self-supporting cantilever wing is not equally possible with a biplane. Interplane struts and stays, therefore, have no real place in the controversy. Couple this with the fact that the lighter structural weight of the biplane gives less induced drag, and we see that much of the vaunted superiority of the monoplane in respect to its low head resistance is a dubious point for the monoplane enthusiasts to raise.

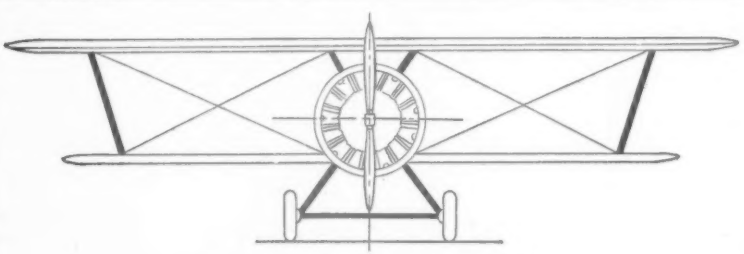
Another compensating factor for the loss by interplane interference with a biplane is the fact that the aspect ratio of a biplane can easily be made more favorable and generally is greater than the aspect ratio of a monoplane of equivalent area. A long slender biplane wing is more easily made structurally sound than a high aspect wing on a monoplane.

Without going into all of the details at this point, it can be said that a biplane can be made more stable than a monoplane, and easier to handle under adverse weather conditions. By various adjustments of the stagger, decalage and overhang, a biplane can be made so self-stable that it is actually too "stiff" to answer the controls. On the other hand, other adjustments can be made that will make the biplane highly maneuverable and with intermediate arrangements a compromise can be struck that gives the biplane the best combination of stability and maneuverability of any type of ship.

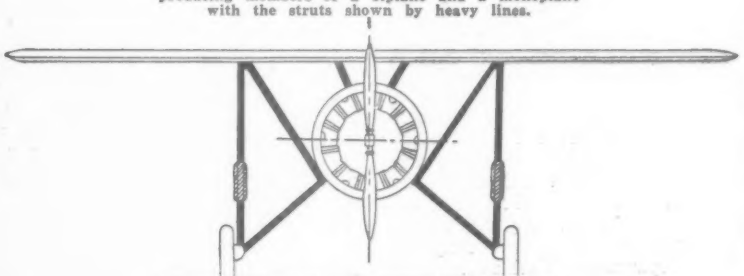
Both the biplane and the monoplane, when improperly designed are subject to flat-spinning, or both of them can be made so resistant to spinning that they cannot be forced into a spin. In this respect there seems to be no advantage for either type of ship, provided that they are properly constructed. It was formerly believed that monoplanes were exempt from flat spins, but experience has proved that contrary is the case.

Biplanes have long been used for

(*Concluded on page 288*)



The interplane bracing of a typical biplane.
A comparison between the external resistance producing members of a biplane and a monoplane with the struts shown by heavy lines.



Landing gear and wing bracing of a typical braced wing monoplane.

Lt. Martinus Stenseth—American Ace

by CARL B. OGILVIE

The daring deeds of Lieut. Martinus Stenseth are recalled by the author and he directs attention to an air hero who has heretofore received but little attention by the press. Stenseth stands among the first of the rough-and-tumble fighters of whom Frank Luke was also an example.

A FOREST reduced to splintered jagged trees; ghosts of their former leafy glory; a vast shell torn, gas-infested devastated area of pock-marked hills; demolished trenches and dugouts; twisted, broken barbed wire.

Heavy thunder of cannons vomiting flames and missiles, shells bursting with such deafening rapidity they cause the ground to tremble in the grip of this man-made volcanic eruption of exploding hatred. And everywhere countless soldiers in khaki and mustard green uniforms are deadlocked at bayonet points.

The ground is strewn with many bodies lying in the mud where they had fallen. Some of them lie very still; they will fight no more—they have paid the supreme sacrifice. It is the scene of the supreme struggle of the American Expeditionary Forces to dislodge the German troops from their impregnable strongholds. The scene of battles that make history; open warfare in the almost impossible Argonne Woods at its highest and bloodiest moment.

Overhead, just above the trajectory of artillery shells, a lone French pilot soars above the Argonne Forest. No place here for a pilot to land if his plane should become disabled. Yet down out of the burning shell-torn heavens swooped six Fokkers.

The telephone bell in the operations office of Aero Squadron 28 jangles petulantly. It is answered by the operations officer. A balloon company reports the enemy winged threat to the French pilot and the American forces sweating, fighting in the quagmire of mud and blood below.

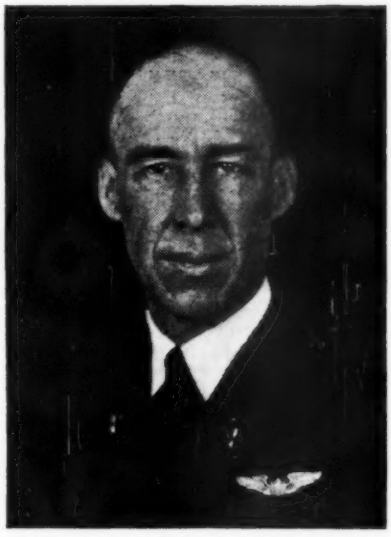
Germans over the Argonne. Germans . . . !

* * *

LIEUTENANT MARTINUS STENSETH, one of the Ace pilots of 28, was on the alert. His Spad was on the line, ready for a take-off. Without waiting for his Hisso motor to be warmed sufficiently, he took off and raced like hell's fire engine to the aid of the Allied pilot. There was no time to climb for the advantage of altitude. Heading into the melee he dove, his machine guns yammering.

In an instant, the Frenchman made his escape and Stenseth found himself the object of attack by the six Fokker pilots. Pulling into a tight spiral he maneuvered to give battle.

Then, without warning, twelve more Fokkers dropped out of the sun, acting as protection of the other six. They



A recent photo of Lieut. Martinus Stenseth who is still in the air service.

came roaring down, bracing wires and struts screaming their hatred. It was a one-sided battle—eighteen to one. But the tall slender pilot from Minnesota had no thought of pulling away after saving the French pilot. His Vickers flamed with a relentless and resolute fury. Tracer smoke drilled at him from all sides.

Spandau lead drilled into the wing surfaces of his Spad. Lead chewed away the windshield before him. He gunned his motor, did every acrobatic he had learned at advanced training school. This was a battle to the finish. The enemy pilots were now toying with him as a cat with a mouse.

They were diving, zooming and darting in at every opportunity that presented itself to send the lone American down to his death. He had to kill or be killed. He fought his way to victory and acedom.

Lieutenant Stenseth, during his short period of duty at the Front of about two and a half months, shot down many enemy planes. Six were officially confirmed victories and at the end of the war he was one of Squadron 28's two Aces.

"Did you realize you were performing a very courageous deed to fight single handed eighteen enemy pilots, when you might have pulled off and beat it for home?" I asked the hero of that day above the Argonne, now a First Lieutenant of the Air Corps in the War Department, Washington, D.C.

"No," he smiled. "If I thought about anything during that scrap I guess it was what a damn fool I was to try and lick a whole German squadron alone. But I got out of it okay."

BUT Lieutenant Stenseth, modest and somewhat embarrassed by being interviewed, didn't mention the most important facts of this one-sided dog-fight which was one of the toughest battles he ever had. He failed to tell me that he downed one of the Fokkers. I have learned from other sources that by his skillful maneuvering, accurate marksmanship and the ferocity of his attack, he forced the remaining seventeen Fokkers to hi-tail it for safer sections of the battle skies.

Let the citation, which went with the awarding of the Distinguished Service Cross to Lieutenant Stenseth, tell the complete story.

> *For extraordinary heroism in action over the Argonne Forest, France, Oct. 22, 1918, Lieut. Martinus Stenseth, 28th. Aero Squadron, Air Service, went to the rescue of a French plane attacked by 6 enemy Fokker planes with 12 additional enemy planes hovering in reserve.*
>
> *Attacking the enemy with vigor, single handed, he dove down and destroyed 1 enemy plane and put to flight the remainder. His gallant act in the face of overwhelming odds proved an inspiration to the men of his squadron.*

Lieutenant Stenseth is one of the few aces of the United States Air Service still in service. He has the military rating of Air-Pilot and Air-Observer.

Soldiering is in Lieutenant Stenseth's blood. It has been since early childhood when, like most boys of his age, he frequently became, in his imagination, General Custer. Astride a broom and with his trusty sword made of a lath and carefully pointed and edged, he roamed vast Western plains in search of Indians.

FOR nearly a year before President Wilson declared war, he had become a soldier. He was a buck private and later corporal in Company I, 3rd. Infantry, Minnesota National Guard. When candidates for officers were called for, Stenseth was sent to the Officers Training School at Fort Snelling. Later he was assigned to the Air Service and received primary training at a French flying school.

He received advanced flying training from the Americans and aerial gunnery from the French. Qualifying, he was sent to the pilots school at Orley, and on August 27, 1918, reported to

the commanding officer of Aero Squadron 28. The squadron was a pursuit squadron attached to the First Army, American Expeditionary Forces; its duty was to protect the St. Mihiel and later the Argonne salients from hostile aircraft.

Because a first victory is always one of the outstanding events of a pilot's war experiences, I asked Lieutenant Stenseth to give me the details of his first successful aerial battle.

He thought a moment, a merry twinkle came in his eyes. "That was an accident," he said.

"An accident!" I remonstrated in surprise.

"It sure was," the Ace assured me. "I was new at the game and didn't know a thing about fighting enemy ships. In fact I had hardly seen more than one or two small fights five miles away. For a time it was hard for me to recognize immediately whether an approaching ship was flown by a friendly pilot or not.

"One day I was out with a flight. I don't know what happened, but the formation suddenly broke up and every man went places. I didn't know why, I guess it was inexperience, but I didn't seem to be able to catch up with any of my buddies.

"And when I came to the full realization that I was a novice pilot, alone in the air without a definite idea where I was—well, I didn't feel any too happy about that.

"Off to the left I saw two planes that looked like Spads. I thought they were from our flight, so I piked after them. After a little stick and rudder work, I dived down to take a position at the rear of the two other planes. Instantly they nosed over and away from me. I went down. They seemed to be trying to get away from me, but I hung on.

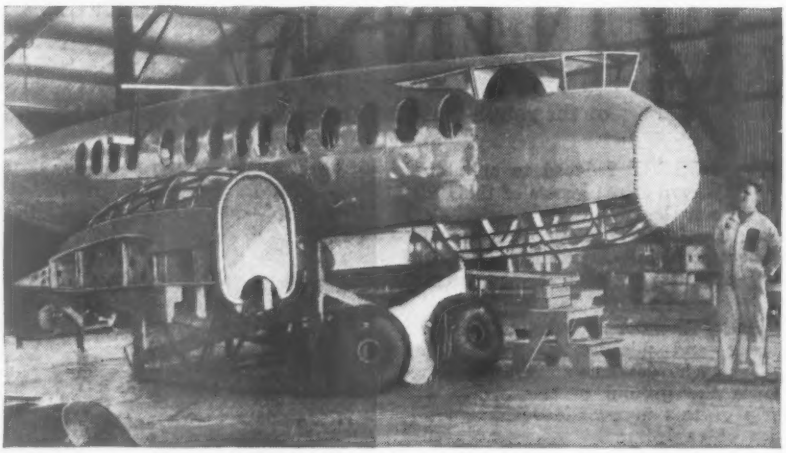
"I realized then that by coming down with the sun at my back they were blinded and probably thought I was a hostile plane. I waved to them and they acknowledged my signal with a lot of extra pointing. Then I noticed they were from a French squadron that had been assigned to work with the American Air Service at St. Mihiel. So I nosed away to look for my own gang.

"Then from nowhere came a plane diving down on me. Then another. At first I felt relieved as I thought they were members of our patrol. But I guess my eyes bulged so far out of their sockets they nearly pushed my goggles off when I saw the crosses painted on the lower wings of the ships. Then I did a foolish thing. Instead of diving away, for no good reason at all, I began climbing up after the Germans. I guess I wanted to know what it was all about. Well, I soon found out!

"TRACER smoke came so close to my face I didn't need to shave for a week. I did some Houdini stunts with the stick and pulled away from

(*Continued on page* 330)

The New Full Size Capelis Plane



The body, wing stub and engine unit of the Capelis plane. Note that the passengers occupy practically the full length of the body because of the support of the rear tandem wing group.

FROM time to time, we have published pictures of the various models invented by S. H. Capelis, but here we see the full size ship under construction. Capelis was assisted in the design by Prof. John E. Younger, Department of Aeronautics, University of California.

The Capelis ship is a tandem wing type as shown by previous photos in this magazine and this accounts for the greater seating capacity as indicated by the long row of windows. This type of ship has been experimented with many times before, but so far has not been very successful.

Prof. Younger estimates that the top speed will be 230 m. p. h. with a 200 m. p. h. cruising speed. This predicted speed is possible with tandem wings.

This is the "Silent Liner of the Air"

IT IS claimed that engine noise has been reduced by fully 50 per cent in this new "Curtiss Condor" transport plane—by running the exhaust under the lower wing.

Passengers can now converse without raising their voices. This is a decided improvement in air transportation and should add much to the popularity of air travel.

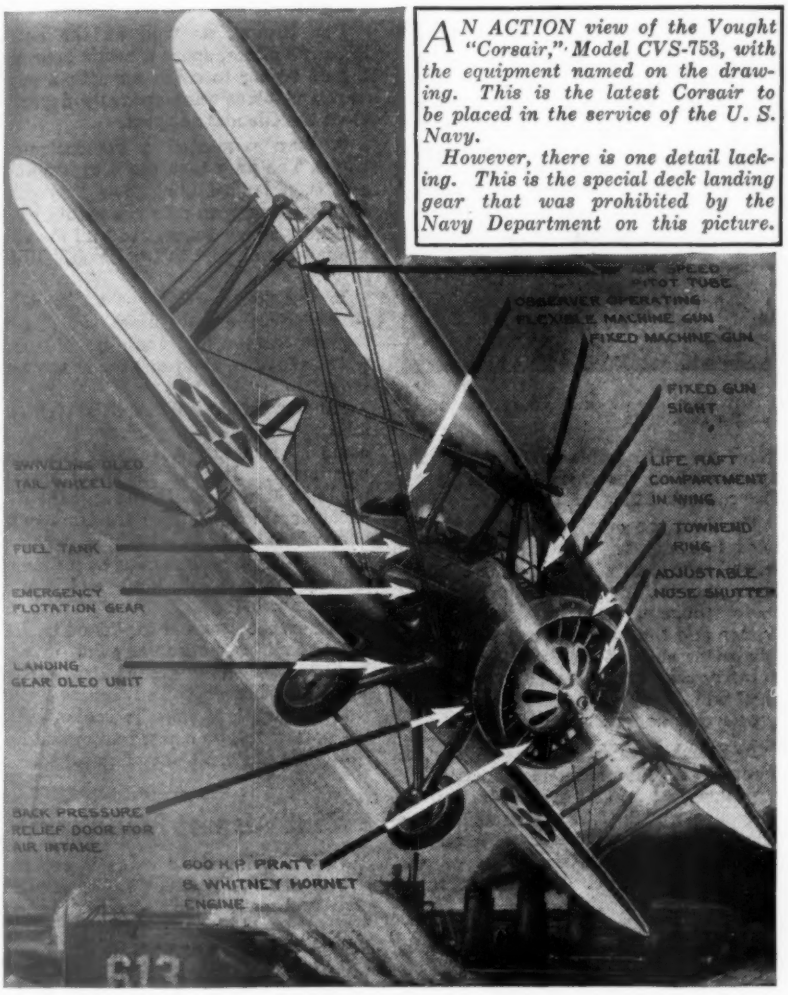
This plane carries 15 passengers and has sufficient room to allow them to walk up and down the aisles for a "stretch." This is another improvement that is commendable in a transport plane. The new "Condor" has a top speed of 170 m. p. h. and a cruising speed of 145 m. p. h.

It will be seen from the accompanying photograph that numerous changes have been made on the exterior portions of the Condor as well as on minor details. The body or fuselage has been more completely streamlined than before and the wing construction has been improved.

The lastest Condor has been considerably revised in form as will be seen above. Numerous modifications have been made in the fuselage and wing cells.

Details of the Vought "Corsair"

A description of the full size Vought Corsair, a later model, though similar to the Geigan model which won Grand Prize in the P. A. contest.


AIR SPEED PITOT TUBE
OBSERVER OPERATING FLEXIBLE MACHINE GUN
FIXED MACHINE GUN
FIXED GUN SIGHT
LIFE RAFT COMPARTMENT IN WING
TOWNEND RING
ADJUSTABLE NOSE SHUTTER
SWIVELING OLEO TAIL WHEEL
FUEL TANK
EMERGENCY FLOTATION GEAR
LANDING GEAR OLEO UNIT
BACK PRESSURE RELIEF DOOR FOR AIR INTAKE
600 H.P. PRATT & WHITNEY HORNET ENGINE

AN ACTION view of the Vought "Corsair," Model CVS-753, with the equipment named on the drawing. This is the latest Corsair to be placed in the service of the U. S. Navy.

However, there is one detail lacking. This is the special deck landing gear that was prohibited by the Navy Department on this picture.

UNDOUBTEDLY, the Vought "Corsair" is the best known biplane in the service of the U. S. Navy and the Marines. It has seen action all over the world in peace and wartime. It served for four years in Nicaragua and accompanied the Marines to China. It flies at every Naval Station from the United States to Honolulu.

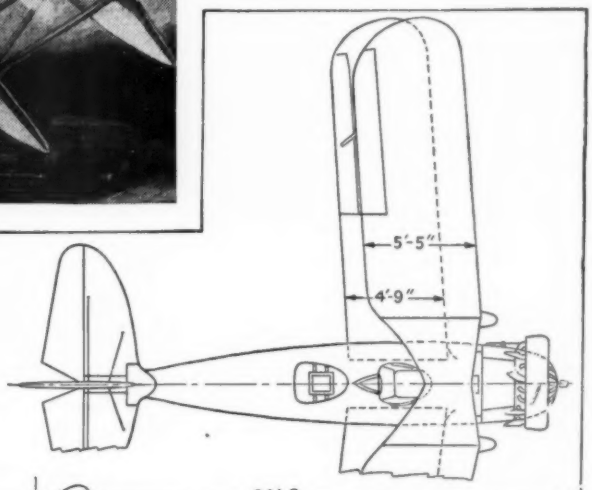
Through the courtesy of the Chance Vought Corporation, builders of the "Corsair," we have been provided with the data and drawings shown here. They have also very kindly checked the equipment shown on the action picture so that all of our readers are assured of accuracy and authenticity of the data.

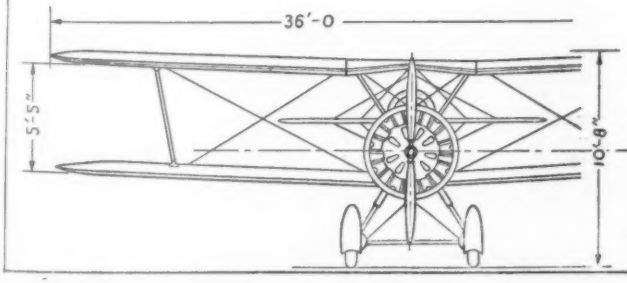
This plane made in several models can best be described as a high-performance military plane of the convertible type that can be used either as a landplane or seaplane by the use of the detachable seaplane floats or land gear. It can operate as an observation, bomber or scout type.

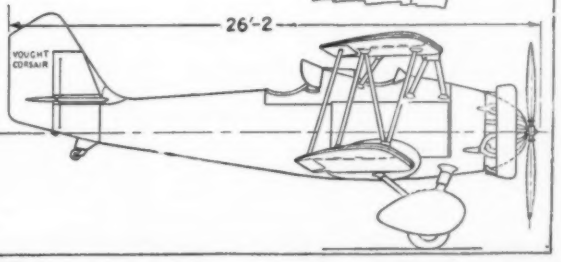
More than 400 of these planes have been delivered to the United States and foreign countries which speaks well for their efficiency and performance. They have been operated from the decks of airplane carriers and from catapults on battleships as well as from land and water.

The VOUGHT "CORSAIR" CVS-753
Color Scheme

Navy gray for the fuselage, landing gear, struts, cowl. Aluminum tail surfaces, but the red, white and blue tail stripes are omitted. Yellow is used for the top of the upper wing, the balance of the wings being painted aluminum. The fuselage and cowling on front cover are red for illustrative purposes only.







To Produce the Vance Flying-Wing

Side view of the Vance Flying-Wing express plane. Clare Vance the designer, is shown standing in front of the ship.

LOOKING forward to the development of high speed air express and mail planes, the Vance Aircraft Co., Oakland, Calif., has designed and built a new type of plane on the principle of the "flying wing" although it is not a true flying wing.

This new plane has a single wing with a span of 55 feet, an outrigger tail, double rudders and a streamlined tailwheel on each outrigger spar. It is a single seater and instead of a fuselage, the pilot's cockpit and motor are streamlined into the wing in such a manner that there is very little parasitic resistance.

In speed tests the plane did close to 200 miles per hour although its top speed at sea level is rated at 185 miles per hour. The thick center section of the wing carries the entire fuel and cargo. At the present time there are ten gas tanks in the wing, having a capacity of 1200 gallons, which would be sufficient fuel for 48 hours of flight, during which time the plane could cover about 7500 miles.

For commercial use, of course, some of the fuel tanks would be removed for cargo space. The landing gear, while not retractable, is of clean streamlined design with a tread of 13 feet. The single motor is a supercharged Pratt & Whitney Wasp, developing 660 horsepower at 2200 revolutions per minute, using a variable pitch Hamilton Standard propeller.

Although the designer, Clare K. Vance, a mail pilot, was recently killed in a mailplane crash, the company is going ahead with plans for additional tests, and the plane will no doubt be on the commercial market later in the year.

The use of outriggers for carrying the tail-group instead of the more common fuselage, eliminates the eddy losses and the "shadow" on the tail surfaces common to ships with a long fuselage. This adds m. p. h. to the speed and at the same time improves the controllability of the ship.

Further, the outriggers can be stiffened laterally with greater effect and less weight than with an extended fuselage, the tail group can be fastened more securely, there is less chance of flutter and the rear end construction is far better and safer all round with this arrangement. The lower view of the ship will show how secure such a tail group can be made.

It seems strange, however, that a tractor propeller was used instead of a pusher, a pusher propeller fitting itself very well into this scheme with a free space behind the wings. A pusher propeller, acting on the wake of the ship, is decidedly better than a tractor screw in the majority of cases.

Plan view of the Vance Flying-Wing showing the twin outriggers.

An Exciting Time at the Airport

THE next time that Lee Brusse, a pilot-demonstrator, lets a prospective buyer taxi one of company's new ships, he's going to tie an anvil to the plane's tail or fasten the throttle closed —anything, in fact, to keep plane and prospect on the ground.

For Brusse, as well as the entire Sheriff's office, spent a hectic hour and a half trying to catch up with a prospect and plane that suddenly departed from the Glendale airport.

A man requested a demonstration flight. The pilot took the prospect aloft and then landed him. The brakes on the low-wing open monoplane interested the man, so his request to taxi the ship around the airport to test them out was granted.

Brusse, keeping his eye on the ship, saw it start swiftly down the airport runway, careen into the air and disappear eastward, the prospect at the controls.

He requested the Sheriff's office to stop plane and customer—if either could be located. A general broadcast was made. Just as darkness settled, pilots at Monrovia Airport saw the ship shoot earthward, strike the runway on one wheel, bounce along in what is known in flying vernacular as a Chinese landing (one wing low) and finally come to a halt.

The errant prospect explained to T. J. (Tex) Phillips, policeman-pilot, that he had unintentionally gained flying speed while taxying at Grand Central; then was so surprised that he couldn't find the port which he started from and had flown around until out of gasoline.

Want Airport Mail Service

ALTHOUGH their value is set at a total of $115,000,000, the commercial and municipal airports in the United States are without a United States Government Postoffice. Clarence Chamberlin, trans-Atlantic flier, told a group of airport architects and civil engineers in New York recently that it was high time to dignify the airport with the proper housing of a government function. He urged that postoffice stations be established at all mail contract airports as a necessary step in the advancement of air mail service.

Bing, Bang — Boom!

STUART FRAZIER, Brooklyn, N. Y., congratulated himself a little too soon when he emerged from an airplane crash without injury.

His son, Clifford, 19, a pilot, lost control of the plane while attempting to land in a strong wind, and the ship was wrecked. As the elder Frazier stepped from the wreckage, a motorcycle speeding to the scene struck him, injuring him so severely he was forced to spend several weeks in a hospital. His son was unhurt in the crash.

The Ins and Outs of Aero Radio

by ALFRED CELLIER

Practical instructions in radio for the private owner who wishes to install a radio receiver upon his plane. This is a straightforward non-technical article on the installation of a receiver and the laws governing its use.

MUCH has been written of radio's part on the airlines and of its use by the army and naval air services. Occasional items have told of its part with planes on antarctic expeditions and trans-ocean flights, but these have all seemed too technical for further consideration by private flyers who could greatly benefit by it.

To begin with, the private owner may purchase a dependable receiving set for as low as $150. There are many good sets on the market that will give him all the information so essential to cross-country flying. The cost of bonding the airplane will depend on its size. A great many of the more recent airplanes have been bonded at the factory during their construction, and consequently the owners will be saved the cost of this work.

The shielding of the engine does not run into a large amount. Considerable expense may be saved, and a great deal may be learned, by the plane owner undertaking to do either part of this work himself. He will familiarize himself with many things, which will enable him to do his own upkeep and service later on.

Undoubtedly, the main hold-back in the acquiring of radio sets by this class of pilots, has been the objection to learning code and spending months of preparation to pass an examination in order to secure an operator's license, so no further interest has been displayed to find out what it really is all about. Nothing could be further from the truth; the use of aircraft radio is available to all those possessing a receiving set of the proper frequencies, so that they may tune in on the weather reports, upper air conditions, airport stations and radio beam.

No operator's license is necessary for this. Many of those who use their ships for business purposes could have paid for such a set many times over, by the time lost in laying over on some small airport due to bad weather and the loss of some big business deal by deciding not to abandon the ship. Many such flights have been started without taking the trouble to get weather reports before leaving. The radio has saved many such a situation by enabling the pilot to go around the storm or given him time to make another decision after he was in the air.

Those who have used the receiving set in their ships, will shortly be desirous of two-way equipment and cast longing eyes on the transmitters. For the transmission of messages from aircraft a license is needed, both by the operator and the station (airplane).

And here they are, with the radio on the bench, getting it ready for installation on the plane. Not a big job but one that requires care.

An operator's license, known as Radio Telephone Operator Third Class License may be acquired by passing a theoretical examination at the government radio supervisor's office.

The requirements for this license are a knowledge of the adjustments and operation of radio telephone apparatus. The ability to transmit and receive clearly conversation by radio telephone apparatus, the knowledge of the regulations applying to the exchange of radio telephone communications, are part of the regulations referring to the safety of life.

After the license has been obtained you are allowed to call ships in flight, airport stations for your weather reports, condition of the field and various other information when making an airport in bad weather. The license for the airplane station is issued after filling out blank forms, giving information as to type and license number of the airplane, make and type of transmitting set, description of the receiving set and the class of service to be rendered.

There are two methods of receiving the radio beam signals, but which will only be mentioned here, due to the numerous articles which have already appeared on this subject. First, the receiving of the signals by the aural or (A) and (N) system through the headphones, and second, by the visual or Reed indicator mounted on the instrument board. This is just one more of the accommodations offered the pilot with a radio equipped plane.

The latest figures of the Radio Division, Department of Commerce, show that there are 121 aeronautical ground stations and 350 aircraft radio stations licensed for operation in the United States, the majority of the airplane stations being ships belonging to the air transport lines. All of these radio aids are on twenty-four hour service and are available gratis to anyone possessing the proper equipment to take advantage of them.

The various frequencies assigned to aviation for distress, calling and navigational work are as follows: 278 kilocycles, calling and working frequency from all ground stations to itinerant airplanes; 333 kilocycles, international air calling frequency; 375 kilocycles, radio compass; 500 kilocycles, international calling and distress frequency for aircraft over the seas; 3,106 kilocycles (97 meters), National calling frequency for all transport and itinerant airplanes; 393, 400, 414, 420, 457 kilocycles, for stations on chains, providing no interference is caused with other services.

For planes on sea flights, desiring immediate frequencies, 333 or 500 kilocycles is used for calling; 414 or 457 kilocycles for working and 375 kilocycles is used for radio compass. However, the private owner about to ac-

quire a receiving set need not worry how he is going to tune these stations as the operation of these sets is no more of a task than the one you use by the fireside to listen to the broadcast programs.

No attempt will be made to describe the various receiving and transmitting sets, but it is recommended that one designed especially for aircraft be used. There are several makes on the market giving excellent results, among these are the Western Electric, the Stromberg Carlson manufactured by the Aircraft Radio Corporation, Lear Development Inc., Westport Manufacturing Company and the Radio Corporation of America.

Some confusion may exist in the minds of those who, after checking over the various receiving and transmitting sets, wonder what it is all about in regard to kilocycles, kilometers and meters, believing that the whole thing is too confusing to them.

Wavelengths are measured in meters, and frequencies in kilocycles. Radio waves travel approximately 300,000 kilometers per second, and if either of the other figures are known, you have the answer. Dividing 300,000 by the wavelength gives the frequency in kilocycles, or dividing 300,000 by the frequency gives the wavelength in meters. They are mutually convertible.

The installation of most of the receiving sets is in the rear of the fuselage, and are operated by remote control; the volume control unit being located on the instrument board, while the headset or earphones plug into the volume control unit.

The receiver itself may be secured either to the side or bottom of the inside fuselage, aft of the pilot's seat. The mountings which are constructed of sponge rubber cushion legs, protect the instrument from any vibration or shocks of landing. The best results are obtained by mounting the receiver; and transmitter, if it is desired to install a two-way set, as close to the base of the antenna mast as possible.

A small model short-wave aero radio set made by the Lear Development Corporation.

BONDING AND SHIELDING

The bonding consists of bonding together those metal parts of the airplane, including the instruments and shielding braid or any other metal part, which are not normally connected to the metallic structure of the airplane (the fuselage). It is important that the airplane be one electrical unit, for charges of atmospheric electricity tend to set up electrical disturbances. This not only would result in severe noise in the radio, but the charges might accumulate until the proportions of the spark at an isolated part created a fire hazard. Control and brace wires which come into casual contact with each other should also be bonded, as well as the metal hinges of rudder, elevators and ailerons.

The five main reasons for bonding are: To increase the electrical capacity between the airplane and the antenna of the radio set. To prevent absorption of the radiated energy of the radio set by metal parts which are isolated from the main metal mass of the airplane. To eliminate the danger of sparks occurring between which there exists a difference in electrical potential caused by the collection of a static charge. To eliminate noises produced in the radio receiver, which are caused by the varying resistance between rubbing or vibrating metal parts. To lower the resistance of the metal shielding in order to obtain effective blocking or localizing of an electrical disturbance.

The shielding of the electrical parts of the airplane requires that the entire system of engine ignition be completely encased in a high-conductive metallic shield. High conductivity may be obtained by using materials that are good electrical conductors such as copper and aluminum. The wires of the lighting system should also be completely shielded as these wires may pick up high frequency energy from the ignition or generator causing serious trouble.

One company has on the market a completely shielded magneto designed especially to eliminate any disturbances that might arise inside the housing. Cans to be used with the semi-shielded magnetos are also available doing away with the necessity of having these especially built.

Shielded spark plugs have been designed solely for use on radio equipped airplanes, and there are several styles of shielded covers for spark plugs that will eliminate any interference. However it is important in using the latter, that the shielding does not interfere with the cooling of the plug.

All of the high tension cables may be housed in the ignition harnesses, certain of which by their flexibility

(*Concluded on page* 324)

Flying Without Hands

This stunt doesn't appeal to us!

NO, THIS is not a stick-up. It is just a picture of Johnny Crowell, Charlotte, N. C., flying his ship "hands off."

Crowell, who claims to be the only "hands off" flyer in the world, ties his hands above him, as shown, and then manipulates all of the controls with his legs and feet. He takes off, lands and goes through all sorts of maneuvers.

He is thinking of making a coast-to-coast flight in the near future—hands off. This will be accomplished by the foot controlled throttle and controls he has invented.

Passengers Carry 85 Pounds Excess Weight

ENGINEERS in designing airplane cabins have pointed out the surprising amount of apparatus which the average human being requires to have carried around with him.

A fair estimate of weights for a 170-pound passenger includes 85 pounds incidental weight distributed as follows: Passenger's baggage, 35 pounds; seat and safety belt, 15 pounds; laminated window glass, 10 pounds; upholstery, rugs, soundproofing, 15 pounds; toilet and toilet compartment, 10 pounds.

Aerial Photography Makes Long Shots

AS IMPROVEMENTS are made in airplane and camera design, photographs are possible at greater distances. By means of infra-red filters the summit of Mt. Rainier was recently photographed at a distance of 266 miles.

Many excellent photographs have been taken from points 30,000 to 40,000 feet above the earth. Stable flying qualities and the ability to reach 15,000 feet with the required load are desirable characteristics of photographic planes.

The cabin must be roomy affording space for operation of cameras and developing or printing when desired. Photographs are made obliquely through the door and vertically through the floor.

Important Changes in Air Laws

The Department of Commerce, Aeronautics branch, frames new revisions that affect the status of the Private Pilot and transatlantic flights.

FIFTY hours of accredited solo flying time will be required of candidates for the grade of private pilot license instead of 10 hours as heretofore, under the terms of a new amendment to the Air Commerce Regulations.

The amendment, made effective March 1, 1933, also creates the grade of "solo pilot" and provides that all privileges heretofore enjoyed by private pilots will now be conferred upon students who have completed 10 hours of solo flying and who pass the tests specified for solo pilots, except that such solo pilots will not be permitted to carry any person except a transport, limited commercial or private pilot.

Holders of present private pilot's licenses will be permitted to fly on their present licenses until June 1, 1933, on or before which date it will be necessary for them to qualify for the new private pilot's license.

The grade of industrial pilot is abolished by the amendment, but licenses outstanding in this classification will be valid for the present.

"The objective sought by the amendment," said Colonel Young, Assistant Secretary of Commerce for Aeronautics, "is to insure that pilots will acquire a substantial amount of experience before carrying any passengers. The change does not affect the carrying of paying passengers, as private pilots have never been authorized to carry passengers for hire and are not so authorized by the present revision of the regulations.

"The solo pilot may use his license for solo flying operations, or he may continue to receive instruction in the ordinary manner and to participate in practice flights, including cross-country solo flights.

"At the same time, qualification for the grade of private pilot is increased to a total of 50 hours of accredited solo flying, 40 of which may be used for any purpose now extended to private pilots except the carrying of any person other than a transport, limited commercial or private pilot. This arrangement will permit a more diversified experience in the preparation for a private pilot's license and attendant responsibilities.

"In giving effect to the foregoing, the procedure will be substantially as follows:

"A student permit will be issued in the ordinary manner—by a physician authorized by the Department of Commerce to conduct physical examinations in connection with aircraft pilot licenses. At the end of 10 solo hours of flying, the student will present himself to a Department of Commerce aeronautical inspector for theoretical and flight tests, and if he passes these tests, will be authorized to fly as a solo pilot.

Is this the beginning of a swan dive or tail spin? Neither. It's just a young lady trying to qualify for pilot's license. Eyes closed and on one foot, she must pose for 30 seconds without falling off the stool.

"Continuing with his flying instruction as a solo pilot, the airman may elect to become an amateur pilot with private license or a professional pilot within the limited commercial grade, as the flying experience required is 50 hours in either case. As a private pilot, the airman will have to meet less difficult physical requirements, with yearly renewal, and the theoretical tests will be less stringent than those for commercial grades.

"As a limited commercial pilot he will be required to comply with the physical standard for commercial pilots with semi-annual renewal, as well as to accomplish a written examination consistent with the privilege of commercial passenger carrying. The flight tests for the private and limited commercial grades will be the same.

"The industrial grade of pilot license, eliminated by the amendment, formerly was issued for commercial work not involving the carrying of passengers for hire. So few applications for industrial licenses have been received that it is considered unnecessary to continue the classification."

WELL, the net result of this will be fewer students. It costs enough now to get a private license, and when about $600 more is tacked on to the expense, flying's not going to be so very popular, from now on. Possibly, the next safety factor will be improved by about 0.5 percent.

Next, they're going to regulate the gay and gallant transatlantic flyer as per the following rules. This doesn't worry us very much, for a salt water hopper is the last thing on earth that frets us. However, this is the way that they are going to protect him.

THE amendment is designed to discourage inexperienced pilots and inadequately equipped aircraft from attempting transoceanic flights and other flight projects to foreign countries. Also, the amendment is intended to insure that permission for flights by American airmen to or in foreign countries will have been obtained from each nation to be visited before the flight is begun. This latter phase has been worked out in cooperation with the State Department.

"Although it has kept a close watch on all such flights in the past, the Aeronautics Branch has not officially intervened in the preparations," Colonel Young explained, "due to the experimental nature of most of such undertakings. In view of the fact that further transoceanic flights with conventional equipment are repetitious in character, we believe that closer supervision in such attempts in the future now is in order." The text of the amendment follows: *Section 36.* FOREIGN FLIGHT.

(A) Entry and Clearance. The entry and clearance of aircraft into or from the United States shall be in compliance with the Entry and Clearance of Aircraft Regulations (Aeronautics Bulletin No. 7-C).

(B) Authorization for Foreign Flight. The owner or pilot of United States registered aircraft shall secure authorization from the Department of Commerce prior to flight, except on regular scheduled operation, over any foreign country other than Canada, Mexico, and Cuba. Such authorization may be issued after permission for the flight has been accorded by the country or countries to be visited and the Secretary of Commerce is satisfied that the aircraft and airmen utilized are qualified for the type of flight contemplated.

Aircraft and airmen licenses may be suspended or revoked for failure to secure prior authorization for foreign flight or for operating in violation of the terms of such authorization issued by the Secretary or for violation of the

laws or regulations of any country over which the aircraft is operated.

(C) Unlicensed Aircraft. Unlicensed aircraft to which unlicensed identification numbers or marks have been issued shall not be flown in any foreign country.

"Under the terms of the amendment," Colonel Young said, "the Aeronautics Branch is working on a code of minimum requirements to be observed by all aspirants for foreign flight permission. This doubtless will include the following salient features:"

(A) That the pilot possess ability to fly entirely by instruments or "blind";

(B) That he possess a substantial amount of cross-country night flying experience;

(C) That he be qualified as a navigator or be accompanied by one;

(D) That the aircraft meet the airworthiness standards of the Department of Commerce;

(E) That duplicates of certain instruments be provided to guard against failure of such instruments when they are needed most;

(F) That the necessary amount of fuel for the project be supplied and that the aircraft shall have the ability to carry such a load.

* * *

It seems that Jimmie Mattern, who flew across the Atlantic last year with Bennett Griffin on a projected trip around the world, was the first pilot to receive this restricted license. He can now legally fulfill his ambition for breaking the flight of Post and Gatty. He will attempt to ring the earth in the ship "Century of Progress."

But let us get back to the much more original topic of the Private Pilot and the Solo Pilot which is of vastly greater importance to aviation than transatlantic flying, or even 'round the world flights.

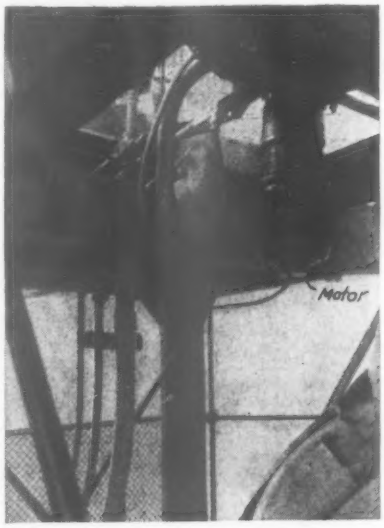
Even with the former requirements of 10 hours solo for a Private License, any school will tell you that there has been a decided scarcity of students due to the depression. And now, just to help things along, further expense and further expenditures of time are necessary before the student can have full liberty with a ship.

Just for a moment, let us look at the present conditions through the eyes of the student who is burning with aeronautic ambition. He is keenly interested in flying even to the point of cramping himself financially but he is no millionaire. Even to get in the former 10 hours solo requirement will cost about $350 at least, and this is a lot of money for a young man today.

Now, he will be compelled to add 40 more solo hours, which at an average of $15 per hour, will run his expense up by $600 more. This means that he will now have to spend approximately $1,000 before he achieves the doubtful benefits of a private license.

Will this fill the flying schools or is it the final parting blow that the law has dealt out to amateurs and private pilots?

The Lindbergh Beacon



Here is the head-house just below the lamp. The motor for rotating the light is shown in the upper right-hand corner of the picture.

LINDBERGH Beacon, atop the Palmolive Building, Chicago, throws its mighty beam of light to a distance of from 100 to 150 miles from Chicago. At night, it is one of the most conspicuous sights around the city.

It is rated at 1,000,000,000 candlepower which is the same thing as crowding one billion candles within a circle of a few feet. It is capable of penetrating thick fogs and mists for several miles which alone is evidence of its terrific power.

The lamp-house stands at the top of a large steel tube mounted on the roof of the Palmolive Building, the tube at one time acting as a support for the light and as a staircase enclosure for the attendents.

At the head of these stairs, and just before reaching the light itself, we find the room shown by photo where the various pieces of electrical apparatus are located. All of the wiring ducts and cables pass through this room on their way to the light, while in the center of the ceiling will be seen the turntable motor that drives the revolving carriage of the lamp through reduction gearing.

She Has Seen Service

THE flying boat in which Wolfgang von Gronau made his trans-Atlantic flight in 1930 has been placed in the Deutsche Museum of Munich.

This action was taken as a German government economy measure, since money for aviation development and use was drastically curtailed in the new budget.

The ship, known as the Dornier-Wal D 1422, is the same one in which Amundsen tried to reach the North Pole in 1925, and two years later Courtney unsuccessfully tried in an Atlantic hop. It still is in good flying condition.

Photo Phans Club

IN THIS issue we note a whole lot of activity among the traders as will be seen from their notices. Further, the Photo Contest has stimulated interest in this department, not only among the members but also among the other readers who have not been collectors in the past.

There is a great deal of competition among our photo collectors this month, to judge from their letters, and the tendency now seems to be toward battle pictures and dog-fight snap-shots. Dog-fight shots are rare, as you very well know, and the bird who has two or three of these pictures in his collection can be mighty proud of his museum. One dog-fight picture is the equivalent of about 500 ordinary photos so far as difficulty in collecting is concerned.

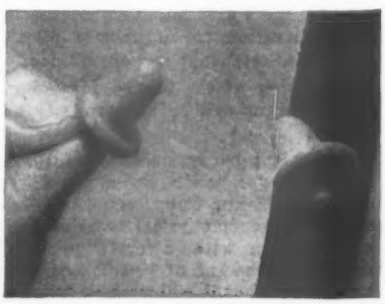
There are only two or three authentic collections of this sort of which the Cochrane-Lange collection is probably the best known and which comprises the most interesting pictures. Then there is a German collection that is quite good. The U. S. Government, of course, has some of this material but it is difficult to get it for publication. We have seen some films (movies) that were taken by the U. S. Signal Corps during the War, but so far have been unable to connect with them.

You will find one interesting announcement among the trade notices this month, the notice of a German collection that should put all of you fellows on your toes. Just take a look at the trade opportunities, there are a lot of them this time.

Ear Plugs Let Sound Through

ALTHOUGH keeping out wind or water, rubber ear plugs designed primarily for aviators let sound through so that there is no interference with conversation or hearing.

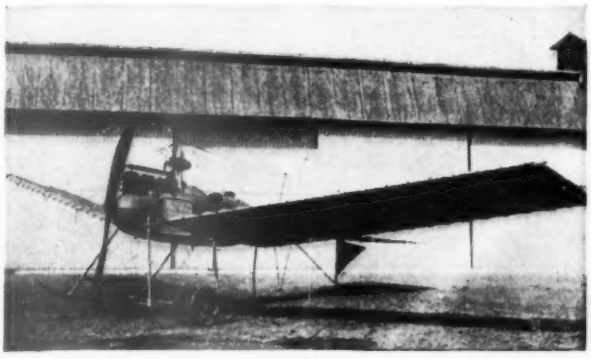
The plugs, made of a particularly fine sponge rubber, have small tabs that make it easy to insert or remove them. They may also be used by automobile drivers to prevent wind from blowing into the ears, by swimmers and by others who require ear protection without sound interference.



This plug excludes the wind and admits sound.

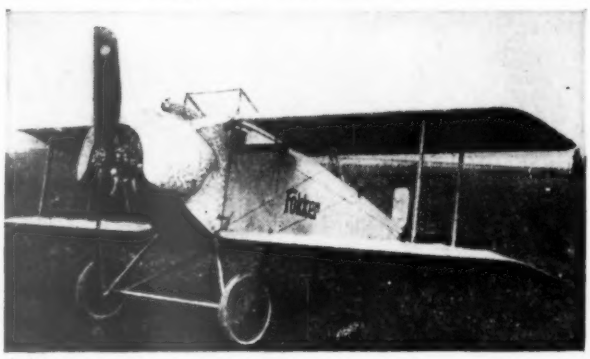
Our Photo Phanatic's Album

Eight warplane photos for our Photo Phans to tuck away in the old album. They are German and English ships, a 50-50 mixture of genuine old timers.

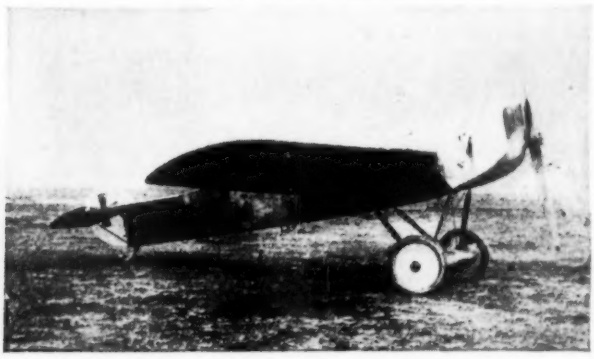


One of the earliest experimental Fokkers, the Model M-1. Equipped with a 4-cylinder Benz.

Fokker, Model M. S. K. M. G. equipped with a Siemens-Halske rotary cylinder engine.

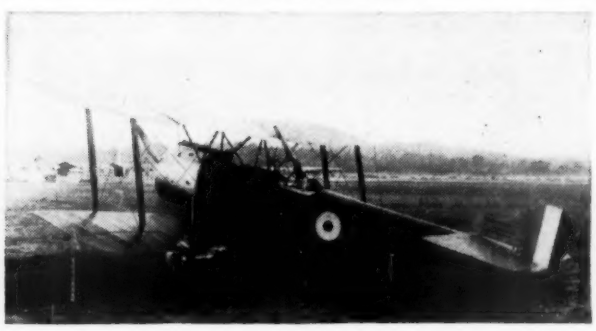


This is an experimental Fokker, Type M-17, with a novel cock-pit enclosure.



Another Fokker monoplane known as the Model V. 23, also equipped with a rotary engine.

A Sopwith "Salamander," known as a "trench fighter." It is equipped with a 200 h.p. Bentley engine.



Here is a Sopwith "one-and-a-half Strutter," Model S. 90. and equipped with a 110 h.p. Clerget rotary.

Here we have the Type S. F. I. Dolphin with a water-cooled kicker. Note the pilot's enclosure.

The Sopwith Type 7. F. 1/5, is also known as the "Sopwith Snipe." Also equipped with a rotary engine.

What About that Hostess Job?

by JOAN THOMAS

Are you one of our correspondents who has been looking for a hostess job? Well, if you are, then you will find all of the dope that you have been looking for in this article.

"HOW can I get a job as an Air Hostess?" "What are the requirements?" "What are the duties of an aerial stewardess?"

The letters have been pouring in from all parts of the country since the story on this newest of professions for air-minded women appeared in the February issue of the POPULAR AVIATION.

There was only one thing to do—investigate!

Mr. E. P. Lott, vice-president of N. A. T. Division, United Air Lines, grinning genially, tilted back in his chair and slanted his Dunhill to the southward as I asked him how he selected the stewardesses on his line.

"That is easy to answer," he said. "The necessary qualifications are few, but it is far more difficult than you may think to find them combined in one girl. The essential requirements can be boiled down to just four points. She must be a registered nurse, have an attractive personality, be good looking and *intelligent!*"

"We will not consider an applicant unless she is the graduate of a large hospital, not that we need actual medical skill, but hospital routine instills discipline and a keen sense of responsibility. We feel that a nurse is trained to handle people of all kinds with tact and yet with a courteous firmness that no other education or training can equal."

"Don't many passengers get air-sick, at least on their first trips?" I inquired.

Miss Dalin caught in the act of providing comfort of her passengers.

"A few—yes. But it is less than one per cent of the total number. True, some of the passengers, nervous and tense on a long trip might become ill. It is here that our hospital-trained stewardess, understanding psychology as well as physiology, with her serene unconcern and friendly suggestions, puts them at their ease and restores confidence."

Thinking of the trim uniformed figure, that a few moments before I had seen at the door of a great air-liner, greeting her passengers with a cheery word and ready smile, I didn't even mention that second point about an attractive personality. It was so obviously her job—her part in the picture.

For after all, though air transportation has become a great industry, organized and run with the same clock-like precision as the railroads and steamship lines, yet it is still so new to the average traveler—that there is something of adventure and romance about every journey through the clouds. Yes, the hostess of this magic carpet must be young and her greetings gay!

"It is easy to find plenty of good looking candidates," Mr. Lott continued "but good looks *and* intelligence—well that is a different story. There are of course, certain physical requirements. Most of our girls are from twenty-two to twenty-seven years of age and will weigh about one hundred and twenty-five pounds. However, those requirements are somewhat elastic, but they must be alert, attractive and above all —intelligent."

Then, so that I might get a first-hand impression of the work itself, Mr. Lott turned me over to Martha Dalin, one of the veteran hostesses of the line. Miss Dalin is the third ranking senior of this newest and most exclusive profession for women, which numbers only twenty-five in its ranks and is yet barely two years old.

She has already chalked up 268,000 miles along the skyways—the equivalent of over twelve times around the world—and that without the excitement of even one forced landing!

"AND people are still afraid to fly!" I exclaimed almost involuntarily as I heard those figures.

"Well, if they are afraid when they start," she said, "they change their minds before it is over unless it happens to be an unusually rough trip. If I see anyone who looks as though they were becoming sick, I can usually kid them out of it."

It was easy to see that this slim youngster in the grey-green uniform

Meet Miss Martha Dalin, the third ranking senior of the airline hostesses.

possessed all the attributes that Mr. Lott had outlined as essential to the job. The cool professional air could not be mistaken, the frank young eyes reflected an engaging personality, while the eager alert bearing bespoke that last and most important requisite—intelligence.

"My duties?" the blue eyes twinkled, "they range from having charge of the ship's papers, tickets, etc., to chasing an Ace of Spades or a pair of dice all over the floor if it happens to be a rough day."

"But isn't it too noisy to carry on a conversation, or even a bridge game?" I protested, remembering a gay tete-a-tete that I had had with a fellow passenger via the note-book and pencil method one moonlit night over the clouds enroute to Cleveland.

"I don't know about the all-metal transports," she replied, "but our ships are very well insulated. The cabins are lined with wood and fabric. We don't have any trouble hearing even in full flight. We organize some sort of a game on nearly every trip.

"Would you like to see the ship? It is time for me to check up on the equipment and I can tell you about the routine of the work as we go along."

We passed out through the busy hangar to where the great air-liner stood on the apron. No one paid any attention to my slim uniformed companion except to wave a greeting or give a friendly nod; she was just one of the

(*Continued on page* 333)

Squadron OX-5 Makes Contact

by ROBERT H. COLLIER

Lightplane Harry, commander of the OX forces, makes a foray into the golf-links zone with disastrous results.

IS THAT guy a pilot! I'm tellin' you —the best I ever rode with and you know that's several since I've been swiping grease down there at the field.

You don't park yourself and gaze calmly upon the scenery when Harry's got hold of the stick, you are too darn interested wondering what's gonna happen next—and it usually does. I don't see why you fellows won't ride with him. He's had almost twenty-five hours more experience than any of these darn transporters around here have had in their lives.

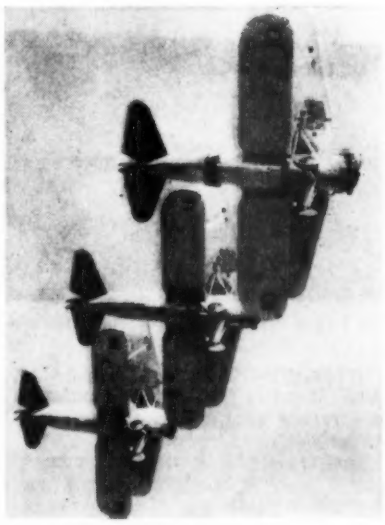
Why, the other day we warms up to take a little hop over town. The motor kinda cuts out but we don't think anything about that. The old OX5 always was a little sneezy, so we takes off. Down at the end of the field, Harry jerks her nose for the sky just like a pursuit ship. When you fly with Harry, you're flyin'.

Well, we was kinda hangin' there just over the end of the field reachin' for alty, when a whole bank of that dang OX cuts out on us. Now, you know what most of these palookas around here would have done if they had got caught that way at a hundred feet! Why, they'ed of stuck her nose down and bounced into a tree or something.

Not that boy Harry. He slaps her over on one wing and brings her back to the field. She kinda brushes the top of a tree as we head back and the ground is coming up in an almighty hurry sideways, but she sets down pretty, right at the edge of the field.

We taxies on down to the hangar to look things over and when we get there —is the boss mad? He's hopping on one foot and his face is as red as a bull-fighter's blanket. He yells to Harry to put that blankety-blank concrete mixer in the hangar and leave it there. Harry replies with much dignity that his crate is all right, he had just forgot to scrape some spark plugs, or something. The old man doesn't say a word, just throws his hands up over his head and goes into the office. Everybody around the hangar is still standing on one foot. They must have got excited about something.

Well, we monkey around with some spark plugs and the carbureter and wind her up. She revs up hearty, so we takes off. You know that golf course down below the field? Well, we were over it and climbing slow but beautiful. You could see little groups of people walking around down there like they was midgets. I wished that we could give 'em a thrill, but knew that Harry wouldn't because he knew that the next time he did he would get reported to the Department of Commerce.



The height of Harry's ambition—to be a squadron leader on a death dealing mission.

You know, Harry and me are always reading war books, so we used to pretend that the people down on the course were German ground troops and we were the Royal Air Force. You should see us give 'em a strafing. We would see a little bunch gathered around a couple of guys out on one of those bright green spots and we would let 'em have it. Over we would go on one wing and then dive for 'em.

That old OX would rev way up, you could see the wings bend back and would those golf players scatter! We might as well have been giving it to 'em with a couple of machine guns. After we would pull out they would stand around and shake their clubs at us while we did stunts like we was avoidin' archie fire.

Once I lost a pack of cigarets that way. Harry got us stuck on our back and couldn't get off, so those cigarets just flowed out of my shirt pocket. I had to hang on because the safety belt was loose—it was adjusted for two people. Well, some of those sissy dopes that played golf down there got us reported to the old man and we had to stop playin' with 'em. He said he was gonna report us to the Department of Commerce.

I knew he wouldn't that time because Harry's dad had bought the crate from him second-hand, and the airport on the other side of town wouldn't mind sellin' a little gas, oil and hangar space after Harry got through being grounded.

To get back to what I was talkin' about, though, we was over this golf course when that darn bank cut out again. There wasn't any gettin' back so Harry sticks her nose down to land. I had to laugh as I thought how those guys would go scatterin' when we squatted in. We would be stayin' for a while though and we might get a crack over the head with a golf club.

Anyhow, we hear sweet music as the motor opens up and we go on. We starts to circle over the river so we can climb some before startin' places. She cuts again and I see where I get a bath. Before we hit the water, though, she speaks up again and we grab enough alty before she goes out complete to glide back to the edge of the field. I've worked up a little sweat but Harry grins and says we had better take a look see at the motor.

The guys around the hangar don't say anything. They've just about got over standin' around on one foot every time we take a hop. They just make remarks about drunks and fools bein' under the protectin' wings of Providence, etc.

The next morning, which was yesterday, Harry struts into the hangar and I knew by all the signs that he has been readin' some more. He's got on his leather jacket and steps around the old crate like he's looking for bullet holes. We tow her out, put on five gallons of gas and while she's warming up I crawl into the front seat. Harry sets the throttle, climbs out and comes around beside me. He tests my safety belt to see if it is tight and then takes a squint at the sky. I knew then that we were in for some war-time flyin'.

"Well, Lieutenant," says Harry, close to my head where nobody else could hear, "what do you think of the weather?"

"O. K. Captain," I says.

"We are now going on a mission over to the other airport. We'll show those cheap dopes over there and any girls that might be around, what a real Royal Air Force landing is."

"A what?" I asks and I know that Harry has been doing some heavy reading while I was at the picture show last night, and that we are in for something new.

"I forget that you are an observer. The kind of landing we ought to have been doing all along. We dive on the field, zoom up, turn over on our back, roll out, then slip into the field and land the opposite way from which we started."

"You mean we do an Immelman and then land?"

"Oh, something like that. If we'd

had this crate and had been in the war we would have licked the whole German Air Force." He got back into his seat after looking the bus over with pride.

I wasn't so sure but I reasoned that we hadn't got killed yet. The crate was kinda patched up, but the motor was good—when it was hittin'. Harry's description didn't sound like any kind of a landing I had ever heard of, but we should see.

Well we took off and started dipping our way over to the other port. I say dipping because that's the way Harry flies. He don't like to just sit up there and let the ship take him places. The nose would go down and you would see the ground then up she comes, headed for the clouds, while your stomach would change places with your throat. He wouldn't do these dips easy, he would do 'em sudden and try to catch you asleep. That's the way he flies.

Well, we gets over the port and sure enough, we see a bunch of cars and some girls down around the hangar. We circle the field. We are the only ship in the sky so we know that people must be watching us. Then Harry wiggles his wings like he was signaling to a whole squadron and I grab for leather. This is gonna be good I think.

We dive and as usual, I think that the crate is gonna come apart. We never had done anything at this port for fear we would get reported, but Harry had said that this was just a landing and what could they do about that? Just be jealous.

I'll bet that the folks around there were all eyes. Anyhow we dived and then zoomed straight up. Harry must have got a little mixed up then, because when we got on our back we didn't exactly roll out and then glide in.

We kinda got messed up on top of that zoom and before you could snap your finger, there wasn't any air left for us to fly in. There we were on the ground, on our nose with all those silly mugs running around with fire extinguishers and first aid kits, and here I am in the hospital.

Naw, there wasn't any fire but those guys kept squirting that juice into the ship anyhow, and I guess I got most of it in my eyes. That's the reason for the blinkers. Ain't it always the way when these Buttinskis start in to do a little helping hand stuff that they mess up the works worse than ever?

Then on top of it, that old fat guy over at the golf links has to go and squawk to the Dep of Com inspector so we get a double dose. It ain't enough with the hospital bills and all but what we get slapped on the wrist with a good fat fine besides!

You should have heard me talking to that Department of Commerce guy a while ago. Do you know what I told him? Nothin'. I'll say Harry is a good flyer. I hope his old man buys him a new ship. There ain't any kick in flying with anybody else, once you've hopped around with Harry.

Question and Answer Department

All questions of general interest on any phase of aviation will be answered authoritatively by POPULAR AVIATION'S Technical Staff.

This Driggs "Dart" biplane carries Warren or "Zig-Zag" interplane bracing, all the members being struts. There are no stay wires.

QUESTION:—E. T. C., Kansas City, Kan. *What is the balancing point on an airplane wing where the center of the weight must be hung?*

Answer:—THIS is the center of pressure (c. p.) and its position varies with the angle of attack. Further the rate of variation is different on different wing sections. Generally speaking, it is located about 30 per cent of the chord from the leading edge at ordinary flight angles.

* * *

QUESTION:—H. P., Chisholm, Me. (1) *Please tell me what causes a plane to rock in the air? This is an extraordinary kind of rocking that I do not think is controllable.* (2) *Can you tell me how many pounds of thrust that it takes to drive the average lightplane through the air, the Heath Parasol, for example.*

Answer:—(1) THERE are many conditions that would cause this rocking, such as slack controls, slack bracing, flutter of any kind, too much dihedral, improper distribution of side areas, etc. (2) The resistance or propeller thrust, varies with the speed of the ship and its climb. Each horsepower produces 3.75 pounds of thrust at 100 m. p. h., hence 40 h. p. will develop 150 pounds of thrust at the same speed. At 50 m. p. h., the engine will develop 300 pounds of thrust.

* * *

QUESTION:—J. E. K., Newtown, Pa. (1) *Is there any reason why lightplanes are limited to a loading of approximately five pounds per square foot while large planes are loaded heavier?* (2) *Might cantilever wings be used on a lightplane, single or double place, with a 30-40 h. p. engine?*

Answer:—(1) LOADING greater than 5 to 6 pounds means higher top speeds and landing speeds, not desirable with a lightplane. If the loading were increased to 10 pounds, the top speed would be so high that a small lightplane engine could not fly it and the landing speed would be dangerously high. (2) Cantilever wings have been used on lightplanes and, with the exception of the expense, there is no reason why they cannot be used.

* * *

QUESTION:—*Is it good practice to place both wings of a biplane at the same angle of incidence with no stagger? Does this arrangement interfere with the stability?*

Answer:—A BIPLANE cell with equal top and bottom wings, zero stagger and equal incidence, is called an "orthogonal biplane cell" and is not much used at present. With different angle of incidence, top and bottom, we have what is called "decalage" and this materially improves the performance and stability, particularly if decalage is combined with stagger.

* * *

QUESTION:—A. E. T., Lakota, N. Dak. *Describe a 180 or a 360 degree turn. What degree turn would a vertical turn be considered?*

Answer:—A 90° turn is a quarter turn (right angles). A 180° turn, equal to two right angles, brings the ship around so that it faces directly in the opposite direction. A 360° turn is a turn around a complete circle that brings the ship back to the starting point. If the climb were started from the horizontal it would be a 90° turn.

* * *

QUESTION:—G. H., Akron, Ohio. *Why is the lower wing of a biplane usually shorter than the top wing?*

Answer:—THERE may be a number of reasons for this. Practically, a short lower is less likely to scrape its tips on the ground during a bad landing. Again, this improves the efficiency of the top wing by reducing interference between the wings, and if the ailerons are in the top wing, they are more effective with a short lower wing.

(*Concluded on page* 327)

"Barney's Bars" New Flyers' Custom

HE'S had his "Wings" since before the World War, has Barney. But he's waited twelve years for his bars and thereby hangs a tale, and, maybe, the inauguration of a new Army Air Corps custom.

Barney—officially known as Lloyd Barnett—is an Air Corps officer rated both as a pilot and an observer.

On July, 1920, he was promoted to first lieutenant in the Regular Army's newly organized Air Corps and was proud of his single silver bar of rank. But the years went on, and he couldn't add the second silver bar of captaincy to the lone one already showing on his shoulder. As time passed on, he made a threat.

"By the spirit of the celluloid cat that chased the asbestos rat into Hades!" said he, "I'll advertise it so that all the world shall know, when I finally become a captain and get that other bar."

His brother flyers heard and promised to help in the publicity-getting. A few weeks ago—twelve years from the time he became a first lieutenant, Barney became a captain. His friends reminded him of the threat and their promises to help.

The official Notification of Promotion ceremony took place and Barney's friends solemnly filed in one by one. An orderly carefully carried in a large box, and he guarded it carefully.

"*Captain* Barnett," said the spokesman, "in recognition of the great honor conferred upon you by our noble and generous Uncle Samuel, we take the greatest of pleasure in presenting to you this small symbol of our friendship—a symbol which, from this date unto eternity shall be known as 'Barney's Bars.'

"You will recollect, Captain Barnett, your promise to advertise your promotion when the goddess of such events should smile favorably upon you. You will recollect our offer of assistance in the carrying out of that advertising project. We sincerely believe that this little symbol, 'Barney's Bars' shall aid in securing the desired results."

With that, the box carried by the orderly was opened and its contents removed. To the startled gaze of the newly promoted officer was revealed a pair of huge, shining, silver bars—giant insignia of a captain's rank! They were pinned to the shoulders of Captain Barnett, causing that officer's manly frame to sag toward the ground. For the remainder of that day, the gleaming evidence of promotion accompanied the captain in his travels about the Southern post at which he was stationed, and evoked the astonished stares of officers, enlisted men and civilians alike.

It is believed by military experts at Barney's post that the presentation of "Barney's Bars" will become a permanently established ceremony, applicable to all newly promoted captains.

The Levasseur Torpedo Plane Used by French Navy

This new French torpedo plane greatly resembles the wartime Breguet when viewed from the side. Note the torpedo position beneath the fuselage.

ONE of the sensations of the winter in French aviation circles has been the new coastal seaplane torpedo-carrier, the PL 14, turned out by the firm of Pierre Levasseur, better known as makers of variable pitch propellers.

The new airplane is a torpedo-carrying biplane along conventional construction lines, differing from similar machines in other countries mainly by the splendid performance which refinements in design have permitted the builders to realize.

A whole squadron of the new machines has been ordered by the French navy, and will be centered on Ajaccio on the island of Corsica, from which it will be able to protect the whole of the French commerce-routes across the Mediterranean, the PL 14's exceptional range of action permitting it to cover the whole distance between France and Algeria.

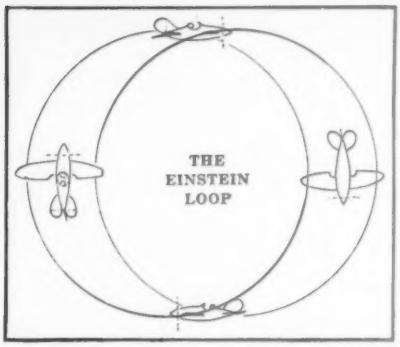
The PL 14 has folding wings to permit ready transport on shipboard and the new French seaplane carrier "Commandant Teste" will also carry a number of these machines. It is a two or three seater, with a water-tight fuselage, capable of staying afloat indefinitely under the most unfavorable weather conditions. The construction is of wood with metal fittings of high-tensile steel.

Richthofen's Albatross in Museum

HERE we see one of Baron Manfred von Richthofen's planes, an Albatross, being wheeled into a permanent exhibition space in a Berlin museum.

It bears a placard reading, "Albatross, Jagd Einsitzer, Typ D. Pflügen von Ritt. Manfred Frei. v. Richthofen." Somehow, the old machine seems to have lost its spirit and no longer looks as spiffy and snappy as it did while flying or standing on the field. Looks only like a stiff museum piece.

Dolling up Richthofen's Albatross for exhibition in a Berlin museum.

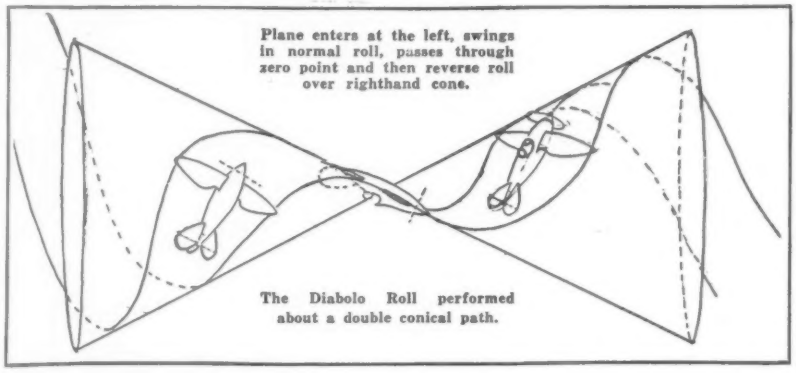


AEROBATICS—

HERE we take up the effect of combining simple stunts into compound stunts which should be perfectly feasible so long as the wings stay on and the engine continues to function normally.

by
LAWRENCE J.
LESH

In collaboration with Clarence Clabaugh, Stunt Flight Instructor


Plane enters at the left, swings in normal roll, passes through zero point and then reverse roll over righthand cone.
The Diabolo Roll performed about a double conical path.

IT IS probably the ambition of every red-blooded reader of POPULAR AVIATION to some day grab the control stick of a rather "hot" airplane and put it over the jumps.

We encourage such thoughts but wish to point out that a certain amount of study and practice is desirable before leaving the comfortable arm chair and flipping outside loops.

The U. S. Department of Commerce has not to date passed any rules or regulations restricting "arm chair" flying so we can safely encourage this sport, in fact we invite our readers to invent new and useful airplane maneuvers and we promise that the best one submitted will be tested out by no less a pilot than Clarence Clabaugh.

Just to show what can be done, the author of this plan who has achieved an enviable record as an arm-chair pilot, having logged about 15,000 hours in the arm chair as well as one year in the hospital as a result of trying out one of his pet ideas, submits a couple of sample maneuvers, merely as a suggestion or example of what can be done—on paper. He hopes these stunts are original but does not guarantee it since he has seen some strange things done in airplanes both accidentally and on purpose.

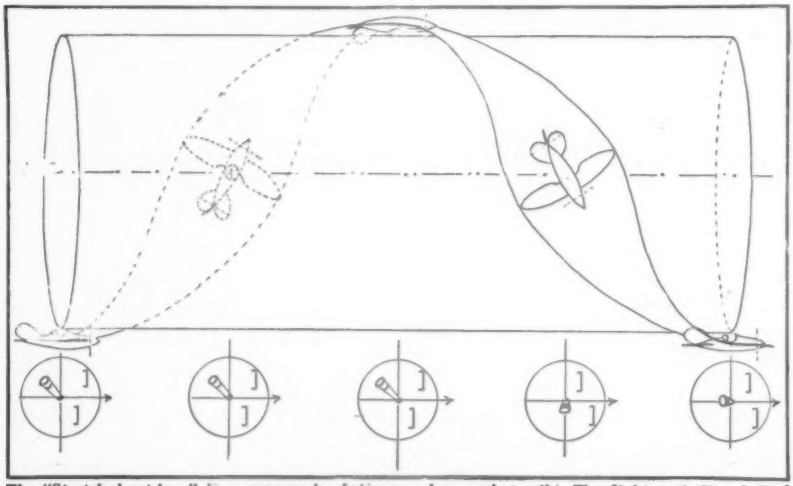
Gaze then, on the Einstein Loop which might also be called the inside-outside loop. If ten readers will ask POPULAR AVIATION why this is called the Einstein Loop the writer will explain the reason, while if any reader figures out the correct answer by himself we will award him the privilege of being the first man to try it out in the air—while we watch.

Simply explained, the Einstein Loop is a loop all balled up with a roll. From the ground it should look just as hot as a regular outside loop but the funny feeling in the pit of the stomach and the sensation that the airplane is trying to throw you into the middle of the next county, should be absent. The "outside" part of the loop is limited to the top of the circle where the speed is cut down which should help a lot.

The Diabolo Roll is a cute little geometrical problem wherein you wrap yourself around the outer surface of an imaginary Diabolo top, one of those double cone affairs that we used to juggle on a string a few years ago. Rolling around the surface of the first cone, centrifugal force would keep you sitting pretty but when you unwind on the second cone you would be doing an outside roll so we hope the strap holds or that the silkworms have done a good job.

Now, the question is, just how would you manipulate the controls to do these stunts? Suppose you draw a little diagram showing where the stick and the rudder pedals should be at each position shown in the loop and the roll, or better yet, figure out a brand new stunt of your own and tell us how you would go through with it. Stick to stunts possible with an ordinary training plane of about 100 H. P. and 100 M. P. H. top speed. We know that almost anything is possible with a modern military pursuit ship but those buggies are not to be found in our stable.

Clabaugh will pick out the most interesting of the stunts submitted from the standpoint of novelty, practicability and clearness of description and will then proceed to try it out in the air. The result will be reported in POPULAR AVIATION and if the winner ever comes to Chicago or Clabaugh happens to visit the city where the winner lives he will take the inventor of the stunt for a ride—and show him the stunt.



The "Stretched-out-loop" is a compromise between a loop and a roll. The flight path is a helical line about the surface of a cylinder, hence it might be called the "Helical Loop." The corresponding stick and rudder positions are shown below.

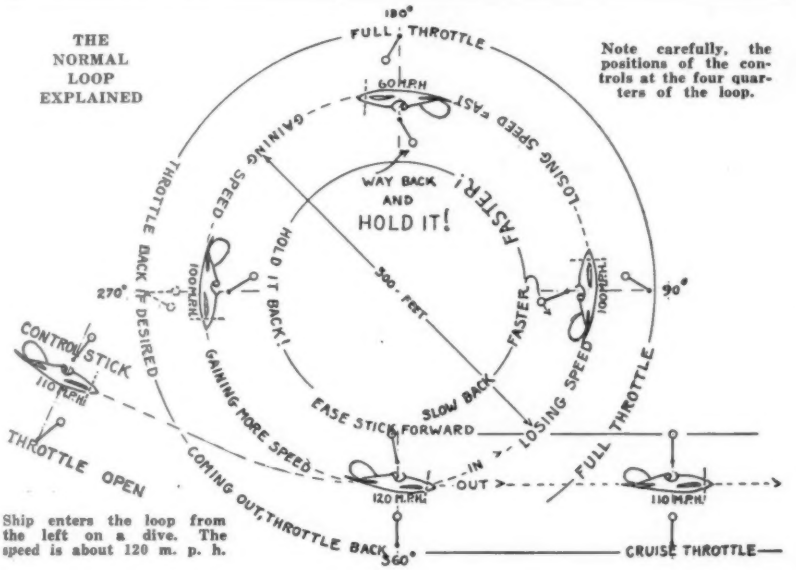
LOOPS AND ROLLS

THE loop was perhaps the first acrobatic flying maneuver in which man, figuratively, thumbed his nose at the birds. As I remember, it was about 1912 that Bleriot figured the stunt possible and built a specially reinforced monoplane in which Pegoud flew the first loop. Shortly after that, the redoubtable Lincoln Beachy felt that he must add the stunt to his program of

NEW LOOPS AND ROLLS

MR. LESH, as usual, has devised a new and thrillingly interesting pastime or game for our readers that has its educational value as well as being an amusement.

It is this. Figure out some new flying stunt along the lines of those suggested in his article, and then sketch out this stunt, showing the control positions. Send it in to POPULAR AVIATION *to compete for the title of "Supreme Arm Chair Pilot."*



thrillers and after a serious accident in which two spectators were killed in his first attempt, Beachey mastered the trick and now the loop is considered about the simplest and safest of aerobatic maneuvers.

Like all other aerobatics the loop and the rolls to be described are an essential and necessary part of the training of a "safe" pilot in their proper place—which is two thousand feet up in the air with a properly packed parachute. Don't get the idea that altitude is necessary just because the Department of Commerce put it down in a book. There are other reasons of a rather deadly scientific nature having to do with what we call the velocity gradient close to the earth under certain conditions of high wind and ground surface which are apt to mean bad news for the pilot who loops low. The dangers of red hot and low-down aerobatics may be taken up in a later article but they are interesting only to pilots qualified by many hundreds of hours flying and by special permits to perform aerobatics at flying meets—students beware!

Now, taking up our routine, the loop as properly performed in a modern training ship calls for a speed of about 120 miles per hour and this means that from full top flying speed the ship must be put into a 25 degree power dive and held there until the necessary speed is attained. Then, with a slow steady pull, bring the stick back until by the time you are upside down you will have the stick all the way back and the ship will go the rest of the way around and come out right side up by itself—so says Clabaugh. And now this highly competent professional instructor will tell you what happens if you do the thing wrong—take the microphone, professor, and spare no details—

"In making the loop be certain that you hold your rudder neutral and also the ailerons—failure on these points will not let the ship do a complete turnover, but it will fall or turn in the direction the pressure is applied. Some pilots throttle their motor back when they are upside down, however, it makes little difference if you do or not.

I seldom throttle the motor back, except when the ship comes around to level flight and then the motor should be throttled to cruising speed. If the stick is pulled back too fast from a diving position until the ship is standing on its tail, there will be a squashing and loss of speed which will make a very sloppy loop.

If you are upside down and the motor sputters, you feel the ship stall, you hang in the belt, all the dirt in the ship rolls down in your eyes, and the sensation is very unpleasant, do not get alarmed, just remember that the worst thing that the ship can do is to go into a spin. Continue to hold your stick back and if you wish, kick rudder one way or the other and the ship will either spin or roll right side up.

Some pilots may tell you that you need to be careful or you will go into an upside down spin, however, this is not so, as it is impossible to spin upside down when you hold the stick back. (I will tell you about inverted spins later.) There may be a feeling that you are going to spin as the ship is doing a roll, but remember you are upside down and it has to roll out of that position. Remember, that when you are doing stunts, the worst that can happen is loss of control and a spin, and if you will simply apply your correction for a spin you will be all right.

There are several different kinds of rolls, the barrel, or snap roll, the slow roll, the aileron roll and the half roll. The barrel roll, or snap, as I will call it, is nothing more than a horizontal spin and it takes very little air-speed to execute it. The best speed is about 80 miles per hour. Some ships roll more easily than others and can be rolled faster, but in rolling at a higher speed the roll will be tighter and it may be so fast that it will make you dizzy, so it is best to practice at about 80 miles per hour.

Throttle your motor back until the ship is cruising at this speed and you are in level flight, then with a fast steady pressure, pull the stick back to the left hand corner of the cockpit and at the same time kick full left rudder. The nose of the ship will rise first, then there is a whip rotation and you see yourself turning over. Now the trick is to come out right side up and when you so desire. You will find that the rotation will want to continue, and if

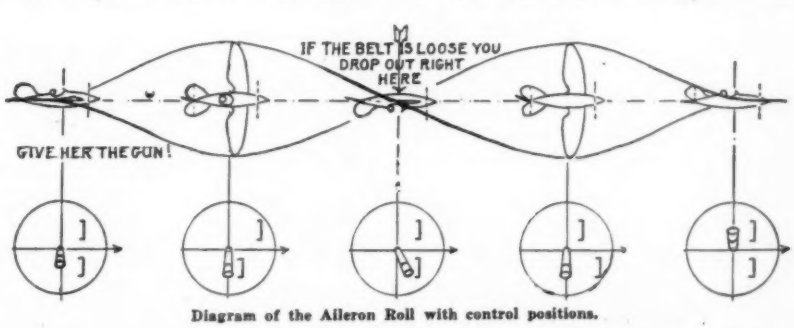


Diagram of the Aileron Roll with control positions.

it does, it will result in a power spin.

When you are about two-thirds of the way around, full opposite rudder must be applied with your stick neutral and a little opposite aileron. Careful timing and practice will let you stop the ship when and where you want to

The slow roll takes much more speed. Open the throttle wide and go about it in the same way you would do a loop. When enough speed has been obtained go through the same motions that you would for a snap roll, but your movements on the stick want to be slow and you will describe a large slow turn over with plenty of speed, also with plenty of control. There is no tendency to stall a ship in a slow roll.

An aileron roll is much more difficult. It consists of a complete turn-over with the nose of the ship on the horizon in a level position and the wings describing a complete turn, or rotation. It is quite necessary that you have plenty of speed, also necessary that you have a good tight safety belt as when you are upside down you will hang in the belt for a short time. It is not necessary that you have a motor that will run upside down, but you will find as you get part way over that the motor will cut out, the speed will carry you on through the complete maneuver.

It is best to have a clear day as it is very necessary to keep your eyes fixed firmly on the horizon. Obtain all the speed possible, then from level flight push full aileron on to the right or left, depending on the way you want to turn. As you get over a 45 per cent bank the nose of the ship will tend to drop and you have to use top rudder to keep the nose on the horizon. When you are about 120 degrees over in the turn shove forward on your stick and take off rudder to keep the nose on the horizon.

Now, if you desire, when you find that you are upside down, you can glide for a short period. To complete the roll keep the aileron on hard and the ship will continue to roll, and as you get over 270 degrees again you will find that you must keep top rudder on to keep the nose on the horizon and as you come right side up you will probably have to bring the stick back to neutral and your ailerons to neutral —thus completing the aileron roll.

It is very essential in the aileron roll that you keep your eyes firmly fixed on the horizon and the nose of the ship on the horizon. Failure to do so will bring the nose too far below the horizon when you are upside down and it will be very difficult to roll out from that position. Probably the easiest way to recover if the nose is dropped below the horizon is to pull the stick on back and complete a half-loop coming right side up.

A half-roll consists of a turn over upside down and a half-loop out, at the same time describing a reverse of direction. It goes very well in military tactics with the Immelmann turn which

(*Concluded on page* 338)

A Pistol Aircraft Camera

This new English "Pistol Camera" is compact and easy to handle.

THE ordinary hand camera is not suited for use from an airplane because of its lack of rigidity, the necessity for holding and operating the camera in restricted quarters, and the need for accurate infinity focussing with a large lens.

The "Pistol" camera illustrated here has been produced to meet these special requirements and so great has been the demand that a new and much improved model has been evolved. The greatest advance has been made in the shutter, which is now of the all-metal Louvre type and gives speeds up to 1-200th. of a second. The fitting of this shutter enables alternate lenses to be offered, including telephoto lenses, which give an image three times as large as that given by an ordinary lens.

The body of the camera, with the grip is constructed throughout of aluminum with nickel-plated trigger. The standard lens supplied is a Ross Xpres of 5.3" focus with an aperture of F/4.5, sufficiently large to enable fully exposed photographs to be obtained at the maximum speed of the shutter either with or without a light filter.

The back of the camera is fitted with runners and a clip fastening to take either plate holders, film pack adapter, roll film holder and focussing screen with hood. No alteration is required for infinity focussing of the lens.

This camera is suggestive of improvements that might be added to small cameras. Essentially this consists of providing a shield of the type shown and a proper shutter system. This should be worked out very easily. The camera, however, should have a shutter speed of at least 1/100 second and should have an unusually good finder.

A view of an English park snapped by the Pistol Camera in full flight. Note that the picture is sharp, clear and full of detail.

More About Aero Clubs

WE have had so many inquiries about forming Aero clubs that we have asked T-2003 for some more dope on the subject. And here it is.

This is real dope that shows a lot of research and experience with aero clubs, and we feel sure that all intending club promoters should send for the literature mentioned in this miniature Question and Answer column.

As pointed out by T-2003 in his article, the promotion and operation of an Aero club is no bed of roses for the officials and a single mistake may turn success into failure with a lot of tempermental members.

* * *

IT appears appropriate to answer certain specific questions on aero clubs which have arisen since publication of my article.

Q.—Do the laws of my state allow such clubs?

A.—Send to the Superintendent of Public Documents, Washington, D. C. for Aeronautics Bulletin No. 18, Compilation of State Laws, price 15c per copy. This also gives dope on whether or not you will be allowed to fly your own home-built airplane.

Q.—Would you suggest a single-seater?

A.—Only for training those who have already soloed. I have just been informed by the Heath Company that they will put out a dual control 2-seater in the Spring to sell for less than $1500 fly-away from the factory.

Q.—Should we build a new ship or buy a second-hand one?

A.—If you want a lightplane, build it. If you want a heavier plane, buy it second-hand.

Q.—Should we start in as a model club or a glider club?

A.—The model club is apt to attract members without the income necessary to allow them to stay in the club when it starts flying activities. They would, however, make excellent *sustaining* members for the club. A glider club will show up the lazy members, as there is a lot of hard work in launching and carrying back the glider. It would, however, divert funds which might better be used for airplane flying. Airplanes are no more dangerous than gliders, I believe.

Q.—Would it be a good idea for six to ten interested men to start the ball rolling and get things all planned before trying to get new members?

A.—An excellent idea. Have these charter members look up the matter of obtaining club rooms and flying field, and the matter of airplane costs and probable costs of flying training. They should, however, be willing to change their views after new members come in—and never enter contracts until the club is completely organized.

Remember that the troubles of your club are just as much of interest to the editor and to the writer of this article as the good fortune you encounter. Let's hear what happens.

46 Years of Aviation

by ALLEN STOKES

From Ader's first free flight with a steam driven model, through the early period of the Wrights' experiments, it has taken many years of development to arrive at the present stage of perfection. Yet in all these years no radically different system has been adopted.

IT HAS taken careful and hazardous experimenting during the past 34 years to arrive at the point where aviation now stands. The very early pioneers in aviation were beset by many difficulties that do not exist today, yet in spite of the many hazards and heartbreaking failures, the old-timers plugged away at it until disaster was turned into success. It was not simply a problem of designing and building a ship, but the constructor had to learn to fly it as well and if he learned to fly before he crashed his brain child, then there was some hope for him.

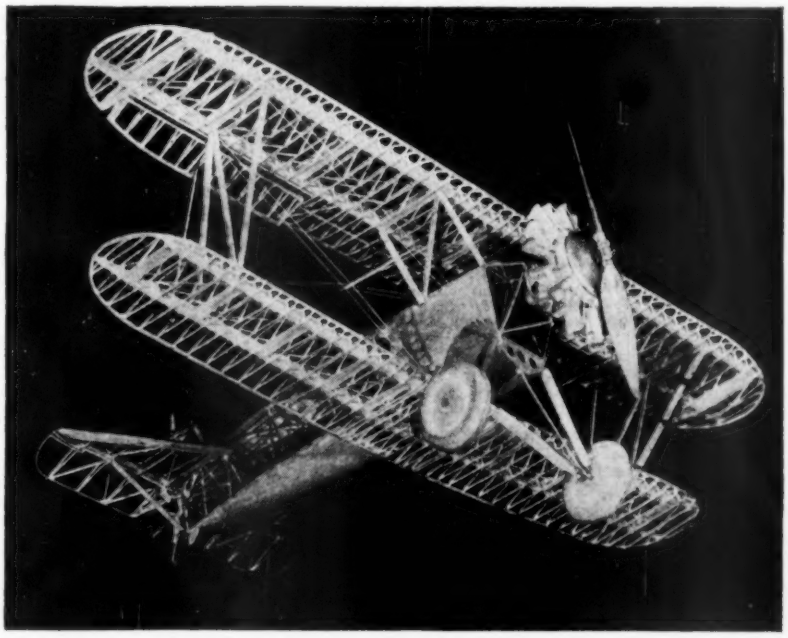
In the following tabulation is compiled a number of early records dating back to the earliest dawn of aviation, and a careful scrutiny of these figures will show very clearly how man literally crawled before he could fly. It was a very slow, dangerous and expensive undertaking and it will be seen that the United States contributed its full quota to the development. The airplane is not the invention of any one man, but is the product of many minds working along in the same channel, each profiting by the success and failures of the other.

In considering the above records, it should be borne in mind that the engine output averaged from 40 h.p. to 60 h.p., with a maximum output of 100 h.p. in a very few cases. In 1911, a successful multiplane flight was made in the United States by M. B. Sellers using a six horsepower motor, the loading being approximately 43 pounds per horsepower. In the same year, as per table, Breguet flew 11 passengers and a pilot, 12 persons in all, with only a 100 h.p. engine. Surely, this is nothing to be ashamed of, even in the light of present machines and their vaunted superiority.

In the matter of speed, the old ships were handicapped by an excessive loading. For example, the weight carried by the biplanes per horsepower ranged between 21 and 41 pounds. And again, there was little attempt at streamlining in the majority of cases, so that the speed was additionally reduced.

Modern ships, on the other hand, are seldom loaded to more than 20 pounds per horsepower, and in the case of racing planes, this may be well below 5 pounds per horsepower. Then there was the matter of streamlining, of which many of the very early ships were entirely innocent. In most cases, the pilot's body was fully presented to the wind and this in itself was the source of very great resistance.

In 1910, when the first Nieuport monoplane was tried out with its completely enclosed and well streamlined fuselage, an immediate increase in speed was noted and in 1911, Vedrines pushed this efficient little ship up to the then unbelievable speed of 93 m. p. h., as shown in the table.



Here are the essential parts of a modern airplane exposed to view in an exact scale model. Perfected in detail through experience in flying but still containing all of the original essential elements used in the first Wright power driven plane. There is not a part showing in this photo that had not been tried out more than 20 years ago.

The Nieuport calls for more than passing notice. It was a very near approach to the modern monoplane and put up an extraordinary performance with very limited power. Equipped with an 18-h.p. two-cylinder engine, it attained an average speed of 52.5 m. p. h., the loading being approximately 35 pounds per horsepower. Provided with a 50-h.p. Gnome rotary engine, it flew the record speed of 93 m. p. h. Thus, twenty years ago, there was a little ship that put up a performance fully equal to that of modern lightplanes, and when we stop to consider the crude wasteful propellers of that time that dissipated much of the engine power, the performance seems even more remarkable.

As will be seen from the table, the duration and distance attained by the early Wright machines far exceeded that of other ships of that time. The Wright Brothers flew miles when others were content to measure flight in feet. They flew in hours at a time when others were ticking off the time in minutes, and again, they were up to 1,000 feet altitude, while their contemporaries were content with from 20 to 30 feet. The little four-cylinder Wright engine with its peculiar system of carburetion kept the Wright ship afloat when other more complicated and delicate engines failed.

Altitude, at first, was not much more than "grass-hopping," the majority of the ships flying at a height of about 30 or 40 feet. Records referring to altitude are rather hazy and inaccurate as the principal objective in the early days was distance and duration.

In 1909, Wilbur Wright's altitude record of 360 feet was broken by Paulham in a Farman, thus setting the new record at 490 feet. Count de Lambert in a Wright biplane, shortly afterwards flew across Paris at 1,100 feet, and a month or so later, Wilbur Wright flew at 1,500 feet, with the Crown Prince of Germany as a passenger. From this time on, the altitude records advanced by leaps and bounds as will be seen.

With a present altitude record of more than 45,000 feet, we have only tripled the altitude of Garros in 1911, or during a period of 22 years, rather a slow advance compared with developments in other engineering fields.

This may have been due to the slow development of the aviation engine and

the general adoption of the crude rotary engines of this time, but what ever the cause may have been, the properties of climb and altitude gaining qualities fell far behind the general improvement in speed and duration.

Looking down the columns we cannot help being impressed by the great preponderance of biplanes among the record breakers from the earliest days down to modern times. This is too consistent to be merely incidental and rather points to the fact that the monoplane is not the highly superior creation that it is supposed to be.

In 1912, at the Gordon-Bennett Cup Races in Chicago, the world was electrified by the speed record established by a Deperdussin which flew around a kite-shape course at a speed of 105 m. p. h. Thus, it took nine years to exceed the modest speed of 100 m. p. h.

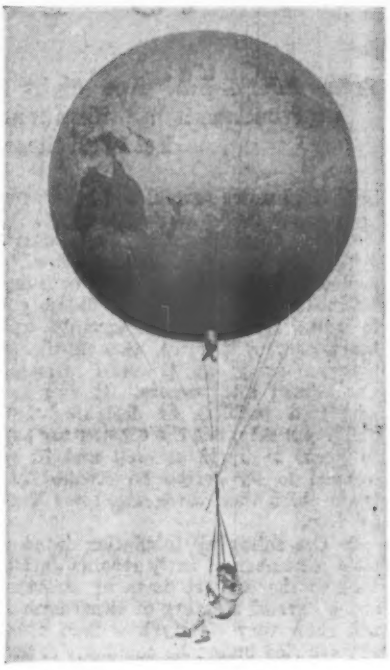
Historical Speed, Distance and Duration Records

Date	Ship and Pilot	Place	Type	Distance	Duration	M.P.H.	Remarks
Oct. 1897	Ader	France	Mono	990 Ft.	.....	....	Steam Model
Dec. 1903	Wright Brothers	U.S.A.	Bipl	.....	12s	....	First Flight
Dec. 1903	Wright Brothers	U.S.A.	Bipl	852 Ft.	59s	....	Fourth Flight
Aug. 1904	Wright Brothers	U.S.A.	Bipl	.....	1m-00s	....	.....
Sept. 1904	Wright Brothers	U.S.A.	Bipl	.....	.....	....	First Turn
Nov. 1904	Wright Brothers	U.S.A.	Bipl	3 Mi.	5m- 4s	....	.....
Oct. 1905	Wright Brothers	U.S.A.	Bipl	24 Mi.	38m- 3s	....	.....
Sept. 1906	Santos-Dumont	France	Mono	26 Ft.	2s	....	First Gas Mono.
Nov. 1906	Santos-Dumont	France	Bipl	690 Ft.	18s	....	Box Kite
Mar. 1907	Delagrange	France	Bipl	660 Ft.	16s	....	.....
Apr. 1907	L. Bleriot	France	Mono	120 Ft.	06s	....	.....
July 1907	Bleriot	France	Mono	485 Ft.	****	....	.....
Oct. 1907	H. Farman	France	Bipl	940 Ft.	21s	....	.....
Jan. 1908	Farman	France	Bipl	0.9 Mil.	****	....	.....
Mar. 1908	Aerial Exper. Assoc.	U.S.A.	Bipl	318 Ft.	****	....	"Red Wing"
1908	A. E. A. (Curtiss)	U.S.A.	Bipl	1000 Ft.	****	....	"White Wing"
May 1908	Delagrange	France	Bipl	7.5 Mi.	****	....	.....
June 1908	Esnault-Pelterie	France	Mono	0.7 Mi.	****	....	R. E. P. Mono
June 1908	Delagrange	Italy	Bipl	10.4 Mi.	****	....	.....
July 1908	Bleriot	France	Mono	3.6 Mi.	****	....	.....
July 1908	Farman	France	Bipl.	11.9 Mi.	****	....	.....
Sept. 1908	Farman (Ferber)	France	Bipl	*******	10m-40s	....	.....
Sept. 1908	Wright (Orville)	U.S.A.	Bipl	*******	*******	....	150 Ft. Alt.
Sept. 1908	Wright (Orville)	U.S.A.	Bipl	51.2 Mi.	1h-14m-24s	....	.....
Sept. 1908	Wright (Orville)	U.S.A.	Bipl	*******	*******	....	250 Ft. Alt.
Sept. 1908	Delagrange	France	Bipl	18.5 Mi.	.....	....	.....
Sept. 1908	Wright (Wilbur)	France	Bipl	.....	1h-31m-25s	....	.....
Oct. 1908	Bleriot	France	Mono	8.4 Mi.	.....	....	.....
Dec. 1908	Wright (Wilbur)	France	Bipl	95.0 Mi.	2h-18m-33s	42	Michelin Prize
Jan. 1909	Hans Grade	Germany	Mono	240 Ft.	.....	24	.....
Feb. 1909	Farman	France	Bipl	3.0 Mi.	.....	42	Passenger Flight
Mar. 1909	Curtiss	U.S.A.	Bipl	8.0 Mi.	11m-15s	40	Silver Dart
Mar. 1909	A.E.A.(McCurdy)	Canada	Bipl	19.0 Mi.	.....	....	Silver Dart
Apr. 1909	Santos-Dumont	France	Mono	1.5 Mi.	.....	....	"Demoiselle"
Apr. 1909	Antoinette IV	France	Mono	1.6 Mi.	.....	43.8	.....
Apr. 1909	Antoinette IV	France	Mono	.....	37m-37s	43.8	Mono Record
June 1909	Antoinette IV	France	Mono	.....	11m-57s	44.0	Passenger
June 1909	Bleriot	France	Mono	.....	.....	....	Two Passengers
July 1909	Breguet (Gobron)	France	Bipl	2.0 Mi.	5m-20s	40.0	Two Passengers
July 1909	Bleriot	France	Mono	31.0 Mi.	37m-02s	56.0	Cross-Channel
Aug. 1909	Farman	France	Bipl	111.8 Mi.	3h- 4m-56s	....	Rheims Meeting
Aug. 1909	Curtiss	France	Bipl	18.0 Mi.	23m-29s	69.0	Rheims Meeting
Aug. 1909	Curtiss	France	Bipl	12.0 Mi.	15m-50s	....	Rheims Meeting
Sept. 1909	Wright (Orville)	U.S.A.	Bipl	.....	1h-35m-47s	....	Passenger Record
Sept. 1909	H. Farman	France	Bipl	137.0 Mi.	4h-17m-35s	32.0	Duration
Nov. 1909	Hans Grade	Germany	Mono	.....	5m-00s	....	.....
Apr. 1910	Farman (Paulhan)	France	Bipl	193.0 Mi.	4h-12m-00s	44.4	.....
May 1910	Curtiss	U.S.A.	Bipl	142.5 Mi.	2h-50m-00s	....	.....
June 1910	Curtiss	U.S.A.	Bipl	149.5 Mi.	3h-27m-00s	....	.....
July 1910	Bleriot	France	Mono	158.5 Mi.	3h-39m-29s	....	.....
July 1910	Antoinette IV	France	Mono	211.3 Mi.	4h-37m-00s	....	.....
July 1910	Bleriot XI	France	Mono	244.0 Mi.	5h-03m-05s	....	.....
Aug. 1910	Curtiss	U.S.A.	Bipl	64.4 Mi.	1h-42m-00s	....	With Pontoons
Oct. 1910	Farman	France	Bipl	365.0 Mi.	6h- 1m-35s	....	.....
Dec. 1910	Farman	France	Bipl	365.0 Mi.	7h-00m-00s	....	.....
1911	Nieuport (Vedrine)	France	Mono	.....	.....	93.0	Speed record
1911	Wright (Fowler)	U.S.A.	Bipl	1155.0 Mi.	28h-53m-00s	....	N. Y.-St. Louis
1911	Breguet	France	Bipl	3.0 Mi.	.....	55.9	11 Passengers
1911	Bleriot	France	Mono	.....	.....	....	8 Passengers
1911	Sommers	France	Bipl	.....	1h-31m-00s	....	7 Passengers

Noted Altitude Records of History

	Pilot	Ship	Place	Altitude
1910	Latham	Antoinette	France	3,280 feet
1910	Brookins	Wright	U. S. A.	6,171 feet
1910	Chavez	Bleriot	France	8,485 feet
1910	Johnstone	Wright	U. S. A.	9,714 feet
1910	Hoxey	Wright	U. S. A.	11,474 feet
1911	Garros	Bleriot	France	13,815 feet

Baby Balloon Jumper



Here is the intrepid aeronaut.

GEORGIE ROSS, age five years, has been doing some high and lofty tumbling with his jumping balloon. With the balloon carefully balanced to carry just a trifle less than his weight, even a feeble little thrust of his foot will carry him and the big bag to a height of 50 feet or more.

About two years ago, great efforts were made toward promoting the jumping balloon in this country, but the equipment was expensive, and the balloon didn't get you anywhere—so what was the use?

The World's Largest Bomber

THE picture on page 304 shows the Barling Bomber, developed almost 10 years ago by engineers of the U. S. Army Air Corps at Wright Field, Dayton, Ohio.

The Barling had a wingspread of 120 feet; carried 2,000 gallons of gasoline. It was manned by a crew of four but could accomodate eight; and was propelled by six Liberty engines—four "puller" and two "pushers." The fuselage was in sections 65 feet long and could carry a 10,000 pound load of bombs for two hours if necessary.

It could fly 95 miles per hour; weighed 40,000 pounds and mounted 6 machine guns and a one pounder. There were no vitally placed longerons or wires which, if shot would disable her; she lived to the glorious age of about two years.

It was the first great step toward the great airliner era and was only abandoned by reason of its low speed, for it was otherwise highly successful.

Pick Out Your Aviation Job

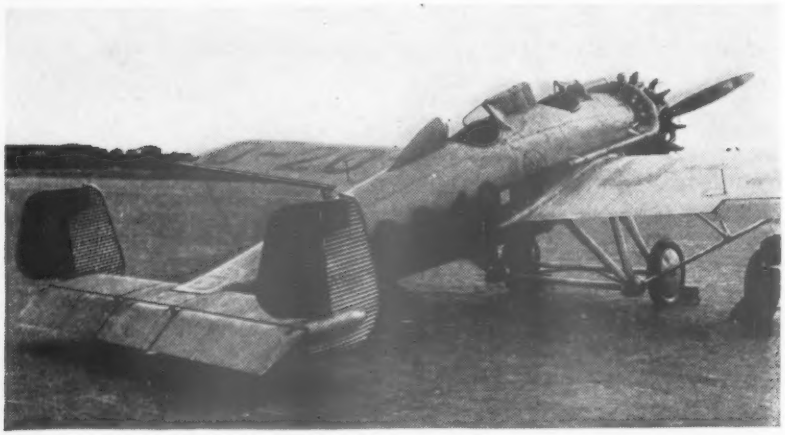
This carefully compiled table, published by special permission of the Boeing School of Aeronautics, will tell all you wish to know about the various opportunities in aviation.

PREPARATORY TRAINING—A high school education or its equivalent in experience is required. To those who are entering high school and who intend to take up aviation as a vocation, it is suggested that the following subjects will prove helpful: English, physics, algebra, plane geometry; (those in office or business work, add: general business courses and training which develops ability to speak before groups.) For those intending to enter aeronautical engineering, college preparatory engineering is required.

OCCUPATION	DUTIES	TECHNICAL TRAINING	SPECIAL REQUIREMENTS	EXPERIENCE REQUIREMENTS	WORKING CONDITIONS	SALARIES	LINE OF PROMOTION	EMPLOYMENT OPPORTUNITIES
CO-PILOT OR MATE	Assisting regular pilot in operation of plane; handles radio messages; on some lines acts as steward.	Complete Master Pilot Ground and Flying Course.	Transport Pilot License; 3rd Class Radio Operators License; ability to meet public; good personality and judgment.	General Flying experience valuable.	From 4 to 8 hours daily; traveling, responsibility, variety.	$125 - $250 with traveling allowance.	Reserve Pilot; Chief Pilot; Senior Pilot;	Developing air transport business presents increasing demand for well trained pilots to qualify as senior pilots.
SCHEDULED AIR TRANSPORT PILOT	Supervising the operation of plane in flight; carries full responsibility of plane, passengers and cargo.	Complete Master Pilot Ground and Flying Course.	Scheduled Air Transport Rating; in addition to Transport and 3rd Class Radio Licenses; judgment; dependability.	A good history as a pilot with experience of at least 1200 hours. Co-pilot experience desirable.	Averages 3 or 4 hours daily flying; responsibility; contact with public.	$300 - $600 per month; base pay is $150 - $250 monthly with milage extra.	Chief pilot; Field Manager; Superintendent of Operations.	Developing air transport business presents increasing demand for experienced transport pilots.
APPROVED SCHOOL FLIGHT INSTRUCTOR	Giving and supervising flight training.	Complete Master Pilot Course. Transport flying and teaching experience.	Approved School License; ability to impart knowledge; good judgment of human nature.	A good history as a pilot with many hours of general flying experience. Air-Line experience valuable.	Average 5 hours daily; responsibility, variety.	Up to $400 per month. A limited number reach top.	Chief Instructor; Director of School; Manager.	Commensurate with growth of air transportation and demand for trained pilots.
SALES PILOT	Demonstrating and selling airplanes.	Complete Master Pilot Course.	Transport Pilot License; sales ability and experience; pleasing personality.	General Flying experience and sales experience on high quality machinery very valuable.	Traveling, responsibility, public contacts, variable hours.	Generally base pay plus commissions and expenses.	District Salesman. Chief Salesman, Executive.	Expanding air transport operations and increase of public interest in comercial and private flying create demand.
TEST PILOT	Testing new and rebuilt planes.	Aero. Engr. training and Complete Master Course.	Ability to interpret test experiences to designing engineers.	Experience with many types of airplanes.	More or less periodic, although income steady.	Determined by ability of individual.	Usually the top. Frequently acts as Consultant for Engineering Department.	Extremely limited.
TRAFFIC REPRESENTATIVE	Promoting of traffic on air transport lines.	Two years college and selected subjects in Master Ground Courses. Master Mechanic Course.	Sales ability, pleasing personality, organization skill.	Railroad or steamship traffic experience valuable.	8 to 9 hours daily; contact with public.	$100-$250 per month.	Traffic Manager; District Traffic Manager; General Traffic Manager.	Expansion program of large air transport operators creating demand for good traffic men.
APPRENTICE MECHANIC	Servicing, maintenance and repair of modern aircraft under supervision.	Master Mechanic Course. Elective: Airplanes.	Carefulness, precision, dexterity of hands.	Machine shop experience valuable.	8 to 9 hours, 6 days per week; variety.	$100-$150 per month.	Licensed Mechanic; Chief Mechanic; Field Superintendent; General Supt.	Developing air transport business presenting increasing demand for well trained mechanics.
AIRPLANE MECHANIC	Servicing, maintenance and repair of modern aircraft; responsible for air-worthy condition.	Master Mechanic Course. Elective: Engines.	Airplane Mechanic License; dexterity, precision, carefulness.	At least 1 year as apprentice mechanic on airplanes; considerable experience with welding, metal, wood and fabric shop experience.	8 to 9 hours, 6 days per week; variety.	$150-$200 per month.	Chief Mechanic; Field Superintendent; General Superintendent.	Developing air transport business presents increasing demand for experienced mechanics.
ENGINE MECHANIC	Servicing, maintenance and repair of modern aircraft engines; responsible for proper functioning.	Master Mechanic Course. Elective: Radio.	Engine Mechanic License; carefulness, precision, dexterity of hands.	Two years as apprentice mechanic on engines; considerable experience in maintenance and overhaul of varied types of engines.	8 to 9 hours, 6 days per week; variety.	$150-$200 per month.	Chief Mechanic; Field Superintendent; General Superintendent.	Developing air transport business presents increasing demand for experienced engine mechanics.
RADIO OPERATOR	Radio telephoning, dispatching, maintenance, and installation of radio equipment.	Master Mechanic Course with Radio Elective.	Aeronautical Radio License; alertness, good judgment in emergencies.	Sufficiently seasoned to handle heavy traffic without confusion.	8 to 9 hours, 5 to 6 days per week inside.	Apprentices $100 - $125 per month; regular operators $125 - $200.	Chief Radio Operators; Radio Technician; Communications Superintendent.	Developing air transport business presents increasing demand for trained communications personnel.
RADIO TECHNICIAN	Installation and maintenance of radio equipment, storage batteries, generators, etc.	Teachers Training and Master Mechanic Course.	Electrical experience and ingenuity; dexterity; Airplane and Engine Mech. Licenses valuable.	Sufficiently experienced to check and diagnose radio trouble.	8 to 9 hours daily, 5½ days per week; inside, some traveling, variety.	$200-$300 per month.	Communications Superintendent.	Developing air transport business presents increasing demand for experienced personnel.
APPROVED SCHOOL GROUND INSTRUCTOR	Teaching aeronautical ground school subjects; supervising shop and laboratory.	Business training; Master Mechanic Course.	Ability to impart experience and knowledge to students; good judge of human nature. Must hold Approved School License.	Broad experience in the industry; specific experience with subjects taught; piloting experience desirable.	8 hours daily; 5 days per week; responsibility, variety.	Comparable to other fields of teaching.	Department Head; Director of School; Manager.	Commensurate with growth of air transportation and demand for trained men.
FIELD MANAGER	Supervising of airport operations; field regulation; rental of hangars.	Complete aeronautical engineering course.	Business experience; sound judgment; ability to handle men; sales ability. Mechanical ability and licenses in all phases.	Airport experience; Piloting experience valuable.	Varies with size of field and number of assistants responsibilities; public contact.	$200 per month and up.	Usually the top. Frequently acts as Consultant for Engineering Department.	Expansion of air transportation activities creating demand for qualified field managers.
AERONAUTICAL ENGINEER	Detail and major designing of aircraft and airports.	Master Mechanic Course.	Good judgment; concentration; accuracy and skill in freehand drawing; strong powers of visualization.	Piloting and mechanic experience valuable.	Inside, light, eyestrain, responsibility.	$200 per month and up.	Chief Engineer; executive positions.	Limited, owing to concentration of manufacturing in few companies.

Note A: **PHYSICAL REQUIREMENTS.** Those preparing themselves for the position of pilot, flying instructor, sales or test pilot, must have good eyesight, hearing and nerve control, good balance, and must pass transport and monthly physical examinations.
Note B: Those holding mechanical, traffic and radio positions must be able-bodied and free from organic disorders.

New Junkers Has Twin Rudder



This double rudder O. C. Junkers is suggestive of many improvements possible in the arrangement of the tail group units that will lead to better control.

WE HAVE a novelty in 2-place O. C. construction shown by the accompanying photograph. This is the Junkers A-48, all-metal construction and equipped with a Siemens-Schuckert "20" engine.

But what strikes the eye from the start are the twin rudders and vertical fins in the tail group—an unusual combination for a ship of this type and size. From all appearances, this should be of assistance in coming out of spins.

German Air Pioneer Dead

GUSTAVE LILIENTHAL, brother and working partner of the better known Otto Lilienthal, died recently at the Adlershof Airport, Berlin, where he had been conducting experimental work.

After his brother's death, Gustav Lilienthal continued experiments in reproducing bird-flight and built a great number of machines, one of which is shown here. He had every confidence in the bird wing principle and discarded all other ideas in favor of his original idea.

Based upon countless bird wing investigations, the first glider was developed by the Lilienthals, and it was these gliding experiments that inspired the Wright Brothers to conduct their experiments which ultimately led to the construction of a successful powered airplane.

While the Lilienthals were not successful in developing a finished flying machine, yet their contribution to aviation was just as useful as a perfected airplane or ornithopter would have been. Their contribution, in the main, was the inspiring proof that mechanical flight was possible and it was largely this data that started the world to work on the heavier than air machine.

The late Gustav Lilienthal standing beside one of his developments in ornithopter or bird flight.

England and International Control

by MAJOR B. J. TEMPLE

THE French proposal to abolish naval and military aircraft and to put all civil aircraft under international control has filled English airmen with consternation.

I can easily explain why. Although the British Empire is wide enough to offer an immense future for commercial air transport, England itself is so small, so superabundantly covered with terrestrial communications, and so disfavoured by climate for aviation, as to preclude home development of airways.

Hence our home-flying commercial air fleets must always be among the smallest and weakest in Europe. As for our Empire-flying commercial fleets, they would be mostly overseas at any given moment. And so, if naval and military aircraft were abolished, and if commercial aircraft were thereby to acquire combative potentialities (in the same way that merchant navies might take-on belligerency if all navies were abolished), a sudden outbreak of war would find us practically defenceless in the air.

Internationalization of commercial air transport would afford us no safeguard against a law-breaking enemy and even in peace-time could only cripple our enterprise. We have ambition to make of our overseas commercial airways as valuable an imperial asset as we have made of our mercantile marine; but our merchant service would have been a poor thing if subject from its infancy to hampering control.

Control, in the sense of check, over civil aviation in any country would be a reactionary interference with the legitimate advance of the science of transport—the most pacific of all sciences. To curtail the development of commercial and private flying because capable of conversion to warlike use would be as panic-like as to curtail chemical and bacteriological research.

Finally, air force (whether military or naval) in British hands has proved its efficacy, economy and humanity for police work in western Asia, and its abolition would render impossible (except at a prohibitive cost in life and in money) the discharge of our imperial responsibilities for the maintenance of law and order abroad.

To sum up. Until human nature softens, until national morals advance sufficiently to make the Kellogg Pact inviolable, and until civilization descends on the primitive parts of the world, nothing but air force can enable us to seek peace and ensue it For years, indeed, Britain has adopted a military air policy of unilateral disarmament, hoping that other countries would follow the example. It has profited nothing. Other countries have taken the opposite course, until at last we are definitely in a position of aerial inferiority to all our great neighbors and most conspicuously to France.

Let's Start the Big Push

Time flies, which is more than we can say for the majority of the home-builders, therefore we urge you to enter your name for membership before this flying season comes to an end. Step on it fellows—500 members by July 1st!

MEMBERSHIP applications have been rolling in all month and at the time of writing, about 20 per cent of the quota have been written down on the roll of membership. Several of the fellows who have gone out after new members, have succeeded in helping the cause along to a very appreciable extent. So far, so good.

But as we are naturally anxious as to the final outcome of this affair, we are still prodding at you fellows who have not yet reported. You must acknowledge that 20 per cent is not a whole big lot. If we are going to accomplish anything this season, we must step on it and step on it hard.

Robert Fretz, a Swiss pilot seated in a Klemm KL-32, has little to worry about in the way of restrictive license situations. There is more aeronautic liberty in Switzerland and Germany than in this country.

Don't forget that three months after this issue reaches you, we will be in the midst of the summer and it will then be too late to extend much help for this year. Then, this will also block our plans for the summer convention and exhibition which will be a real loss to the lightplane fans.

In the meantime, most of the legislative bodies have turned down the screws another notch on the necks of the amateurs. No opposition having been offered to the oppressive laws so far, they are just going a little bit further each month until everything but the scheduled airlines will be ruled off the air. As you will see in this issue, the Department of Commerce has changed the status of the private flyer.

He is only a "solo flyer" without any rights at all until he reaches 50 air-hours. Then he becomes a "private flyer" with the expense and time of 40 more hours added to his bank account. We are now looking forward to the probably not distant future when a private pilot will require about 2,000 hours to make him eligible for using his own ship.

Each month and each year sees the regulations grow more and more exacting, more expensive and more burdensome. No new improved gun in the U. S. Coast Guard anti-aircraft batteries has proved so effective in shooting down ships as the present laws have been in shooting down amateur flyers and home-builders. "Clear the air and air-lanes for the transportation companies," is the cry. And believe me, they are doing it with a vengeance.

To our members' way of thinking, the powers have no more right to rule a private plane or pilot out of the air by imposing prohibitive laws than they have a right to order a man out of the public streets. We can hardly imagine any legislative body that would impose such restrictive laws on automobiles and motorists that they would be denied the use of public highways, but they are getting away with this in aviation.

There are no laws prohibiting an amateur mechanic from building a home-made automobile in his basement nor from using this vehicle on public streets, yet they have ruled the amateur and the amateur plane from the air without winking an eye-lash.

"If commercial aviation is to succeed," so they tell us, "the airways must be kept free from annoying and dangerous private flyers. The public riding in commercial airline ships must not be endangered by reckless private pilots."

As we see it, this is equivalent to ruling privately owned automobiles off the highways because they would endanger the lives of passengers riding in interstate buses.

Then this stress analysis business is driving the small builder into despair. It costs about $1,000.00, on the average, to complete an acceptable stress analysis and this is more than the total cost of an average lightplane. We take no account of the loss of time and the worry that is imposed upon the amateur during construction but this would easily add another $1,000 to the expenses.

Well, we've had our little howl out all by ourselves just to show you fellows that conditions are not improving as time goes on. If the Department of Commerce can spend big bunches of money on the development of airway beacons, radio beam experimentation, auxiliary airports and all the rest of it for the transportation companies, why can't they come out of their shell and lend a helping hand to the amateurs who really started and developed aviation in the beginning?

As we have remarked, many times before, there is only one positive cure for this dilemma. It is for the amateurs to bond themselves together in a national association and have competent persons defend their rights, repealing all objectionable laws. The association now in the process of organization is being assembled for this purpose so that it is to your benefit to become a member at the earliest possible moment. Next month may be too late.

At times, it seems as though we will have a large percentage of our membership built up of the inactive group. There are many members who do not own a lightplane but who have joined for the purpose of clearing up the situation before they do purchase a plane or else have joined simply to lend their support to a meritorious movement.

And so the only thing to do in the meantime is to adopt a stand of watchful waiting until the membership grows to the point where we can actually do something about aviation laws and liberty. We hope that the membership will be 50 per cent complete, at least, by the time that the next issue reaches you. It seems as if this might easily be done if you will all act today instead of putting the job off until tomorrow.

Announcement

AFTER interviewing a number of officials, we are sorry to announce that a home-built plane bearing only an identification number cannot be flown into Illinois.

It is with great regret that we inform our active members that they cannot fly to Chicago in an unlicensed plane nor in a plane bearing only identification numbers. If your plane enters this state it must come in by freight.

In a way, this is a good thing for it brings the present unbearable restrictions into greater prominence than ever. It is just one more example of the discrimination against amateurs.

King Snake Kinks Rattler's Ambition

UNCLE SAM has a school in Texas where potential observers of the Army Air Corps are trained in the science of air observation. Recently, it was their privilege to witness a thrilling demonstration of the tactics of reptilian warfare—a demonstration not usually included in the curriculum of the school.

A ring of excited, shouting students and officers encircled the field of battle in which two rapidly squirming, twisting objects were disclosed.

"Bite his ears off, Kingy," shouted one breathless Flying Cadet to a combatant.

"Bite your own ears off, feller," retorted another student, "Old Man Rattler's got 'im going every which way!"

There you have the secret! A rattler and a king-snake were engaged in mortal combat. When the fight was first noticed, the two snakes were twisted together in a manner which made it difficult to identify one from the other. The king-snake had a death grip on the head of his opponent. Once or twice the rattler broke free, but after about twenty minutes of active maneuvering, the king snake, true to his name, emerged as victor.

Celebrating the victory with a truly regal feast, he swallowed the rattler whole—skin, bones, rattles, and all. Then with triumphant mien, not even deigning to notice the admiring airmen who had witnessed the fight, he glided lazily upon his way.

Air Travel Solicitors — Read This

PILOT H. G. ANDREWS of the Transcontinental and Western Air Lines got a customer for his line in a novel manner recently.

So, believing that the solicitors and agents of the various airlines will be interested in the details of getting new business, we attach this suggestion.

Pilot Andrews, who lives in Newark, N. J., when not flying mail and passengers between Newark and Columbus, Ohio, found an empty milk bottle with a note inside one morning when he went out on the porch to get his milk.

"What is the fare on your planes to Chicago; when do they go and how long does it take?" read the note, which was signed "Milkman."

The next morning Andrews replied via the empty milk bottle telling of the seven-hour service from Newark to Chicago and that rates were about the same as rail plus Pullman. "May I make a reservation for you?" he added.

"Please make reservation for my boss on next Wednesday," read the next milk bottle note.

And a few days later the milk bottle made its final report.

"Boss had a swell trip. Thinks there's nothing like it. Thanks a lot."

The Wibault-Penhoet is a New French Trimotor

by FLETCHER PRATT

Showing the tremendous size and novel features of the Wibault-Penhoet trimotor transport plane. She can fly on one engine if necessary.

WHEN the Wibault-Penhoet firm, announced recently a new three-motor job which was to have a cruising speed of 126 miles per hour, 25 miles an hour faster than the Handley-Page and Junkers machines that are the standard equipment of the best-known European airlines, aviation authorities were not slow in declaring that it was an impossibility.

Now, after three months of service on the Oriental lines of the C.I.D.N.A., one of the most important of European transport lines, the Wibault-Penhoet machines have proved themselves not only the fastest of European transport machines but the most practical as well. One of the new giants recently covered her entire run, a distance of several hundred miles, flying on a single motor and another made the difficult Alps crossing on two motors.

As a result, the new Wibault-Penhoet machines have been adopted by the Air-Union transport lines and several of them are being placed in service on the Paris-London route together with a whole fleet for the long route from Marseilles to Saigon in French Indo-China.

The machines that have done so well in making these records for speed and reliability are three-motor low-wing cantilever monoplanes, of all metal construction, provided with accomodations for ten passengers and a crew of two together with full radio equipment. The fuel tanks are located in the wings, thus giving room in the fuselage for an exceptionally large luggage compartment.

In addition to these advantages, the new transport planes are readily disassemblable and all parts are standardized. The first machines for the Marseilles-Saigon route were shipped to Indo-China by boat and inaugurated the service by starting from both ends of the world at the same time.

Fully loaded, the new giants of French commercial airways weigh 12,175 pounds, of which 2,788 pounds is payload, a figure which makes the performances of the machines that covered their runs on one and two motors respectively, something like a world's record.

The Wibault-Penhoets have a wingspread of 72 feet, a length of 54 feet 9 inches and a height of 18 feet. They are powered with three Gnome radial motors of 350 horsepower each. In tests conducted by the C.I.D.N.A. before placing the experimental machines in service, they showed a maximum speed of 161 miles per hour at 5000 feet altitude and attained a ceiling of 23,000 feet without difficulty.

The motors are fitted with superchargers to aid the machines in covering the numerous mountain ranges they encounter in the course of their runs. They have an endurance of over 600 miles with full load, slightly less on two motors.

How much of an advance these new machines represent over the standard European equipment for commercial airlines can be realized by comparing their performance with that of other multi-motored machines now in commercial European services:

Machine	Motors	Speed	Line
Wibault-Penhoet	3 Gnomes 1050 HP	126 m.p.h.	C.I.D.N.A. Air-Union
Savoia	3 Walters 720 HP	115 m.p.m.	Aera Meditteranea
Fokker	3 Jupiters 1500 HP	111 m.p.h.	K.L.M.
Junkers	3 Jupiters 1448 HP	101 m.p.h.	Lufthansa
Handley-Page	4 Jupiters 2220 HP	101 m.p.h.	British Air Lines

The fastest airplanes in European commercial service are the Lockheed Orions used by the Swiss air firm, but these are one-motor machines flying over short runs, and not properly comparable with the 10-passenger giants that have to cover lines like that from Marseilles to Saigon, half way round the world.

However, these speeds seem ridiculously low when compared with the cruising speed of 200 m. p. h. which is being attained by several American transports. And in view of the fact that one of the American ships has a cruising speed of 220 m. p. h., it is likely that 250 m. p. h. will not be far from the mark in next year's operations.

What Is the Octane Number?

by THE TECHNICAL STAFF

Here's an article that will settle that long repeated question "What is Octane Number and what does it signify when we purchase gasoline for an aviation engine." This article tells the whole story in simple non-technical language.

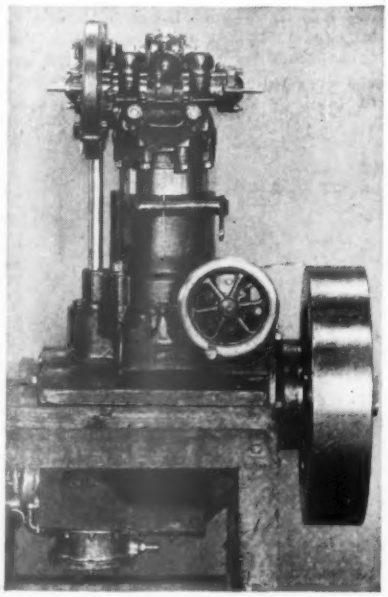
GASOLINE is like the weather. Everyone talks about it. However, few take the trouble to learn much about it in a technical way.

It is composed of three series of liquid chemical compounds called hydrocarbons, the *paraffins*, the *napthenes* and the *aromatics*. Each of these series in turn is composed of several individual members and these individual members have boiling points ranging from 140° to about 400° F.

Depending on where the gasoline is taken in crude oil form from the earth, and also on how the gasoline is refined, the percentage of these series and the percentage of the members in each series vary considerably in gasoline. It is the variation of the percentage of these different constituents which determines the nature of the gasoline and its effect. To the user of gasoline, the most important qualities to consider are its anti-knock value and its volatility.

The tendency to detonate is one of the most important factors. The limit to which the compression ratio of an engine can be raised, and therefore the limit to power output and efficiency, is governed by the conditions which control detonation and preignition.

The measure of the anti-knock qualities or the non-detonating qualities of a gasoline is expressed in terms of octane number. The higher the number, the better the anti-knock quality.

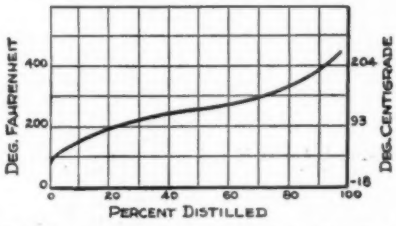


Side view of the standard gasoline testing engine, a single cylinder type that can be adjusted to burn the gasoline under all ordinary conditions.

The gasoline to be tested is run in a small engine and the engine is loaded down until it causes the gasoline to "knock." Then the fuel on which the engine is run is changed to a mixture of octane and heptane. Octane and heptane are two simple hydrocarbon liquids that have widely different but definite anti-knock qualities, when run in the engine and are the basis of measurement.

The mixture of octane and heptane, on which the engine is run, is then varied until the same degree of knock is obtained with the same load. The percentage of the octane in this mixture is then the "octane number" of the original gasoline tested. Thus, the octane number of gasoline is nothing more than the comparison with standard octane and heptane.

In relation to their anti-detonative qualities the aromatics are the best. Napthenes are next and paraffins are the worst. Certain substances can be added to gasoline to increase its anti-knock value. Ethyl, or rather tetra-ethyl lead, is one of the best known of

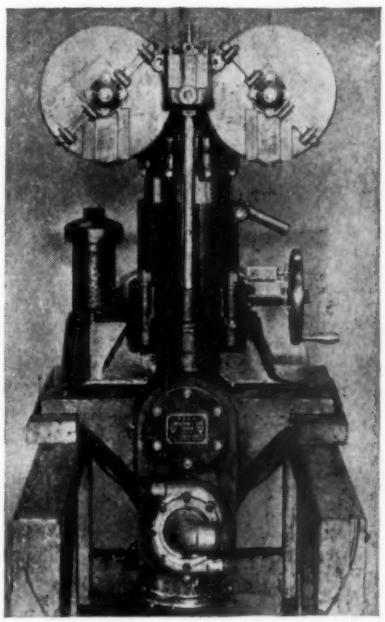


Normal gasoline distillation chart showing the percentage of the "fractions" that are distilled from a gasoline at different temperatures. The distillation range of gasolines varies greatly

the "anti-knocks." Benzol and alcohol are two other fuels which if added to gasoline decrease its knocking. Benzol was one of the first anti-knocks used while the suppressive effect of alcohol is well known and is used to a great extent in Europe.

The shape of the combustion chamber of the engine and other factors affect the compression ratio at which a given fuel will detonate. Therefore, it is impossible to compare fuels on the basis of compression ratio alone at which knock occurs for all classes of engines.

When detonation takes place in an engine cylinder, the action is as follows. First, consider the explosion taking place in an engine cylinder to last for a long period of time. After the cylinder is filled with gasoline and air, the compression stroke will raise the temperature about 600° F. Then the spark occurs, the fuel mixture at the spark-plug starts to burn first and



Front elevation of the standard gasoline testing engine equipped for variable compression.

as it burns it gets hotter and expands.

The expansion of this first gas compresses the unburnt gas in the cylinder, and as this compression takes place quickly, the temperature of the unburnt gases rises so fast that they cannot get rid of the heat of compression by transmission of the heat to the cylinder walls. The result is that the gasoline-air mixture gets so hot that it ignites and explodes spontaneously.

This action causes an explosion wave that strikes the walls of the cylinder with a hammer-like blow, producing the "ping" that is heard when an engine detonates.

There are many theories as to why different substances will retard detonation. We cannot go into these here. Principally they are supposed to slow up the early burning of the gasoline in the cylinder, so that the rapid rise of temperature is avoided.

A fuel having an octane number of 73 or more will not cause destructive detonation when used at full throttle under the most severe operating conditions with most modern aircraft engines. Some of the cheap low test automobile gasolines on the market, which seem to run reasonably smoothly in cars, are about 54 octane number.

Since gasoline consists of constituents which have various boiling points, the percentage of these different constituents must be controlled. For example, aviation gasoline must contain

a sufficient proportion of low boiling (highly volatile) constituents to permit easy starting of a cool motor, but these constituents must not be present in excessive quantities as this introduces a tendency toward premature vaporization in carbureters with resulting "gas lock."

The presence of an undue proportion of high boiling constituents is undesirable as this may cause irregular distribution to cylinders and excessive dilution of engine oil.

Volatility is usually determined by means of a distillation test made under carefully specified conditions. The interpretation of results is best illustrated by the example of the United State Government specifications for Aviation Gasoline. These specify maximum temperature limits for the 10 per cent point in the distillation range, the 50 per cent point, the 90 per cent point, the 96 per cent point, and the "end-point" (final boiling point).

The maximum temperature at which 10 per cent of the gasoline boils off, or the 10 per cent point, insures that the gasoline is sufficiently volatile at low temperatures to assure easy starting. Since "gas lock" may be encountered if the fuel is too volatile, the volatility at low temperatures is further controlled by specifying a maximum allowable vapor pressure. The limits on 90 per cent point, 96 per cent point, and end point insure against tendency toward poor distribution and excessive oil dilution. The limit on the 50 per cent point, in conjunction with the other limits, insures the desired average volatility.

Experiments have shown that, apart from the limitations introduced by detonation, the power output obtained from all volatile liquid fuels, (with the exception of alcohol) is the same at the same compression ratio to within less than 2 per cent. In other words, the efficiency of all gasolines is practically the same. Of course, this neglects the practical considerations of vaporization and even distribution of fuels to all the cylinders of an engine.

And now, owing largely to economic conditions, the government is urging the use of alcohol in combination with the gasoline. This combination, when properly blended, produces an anti-knock engine fuel that has many desirable qualities. The principal reason for this compound fuel is to increase the demand for farmers' produce or alcohol bearing grains and starches.

Alcohol-gasoline fuels have much to recommend them in addition to being detonation proof. Alcohol reduces the tendency toward forming carbon in the cylinders and improves the lubrication of the cylinders by reducing dilution of the lubricating oil. These are important improvements.

However, it is difficult to avoid separation of the gasoline and alcohol, and again, the alcohol tends to absorb moisture from the atmosphere which will cause trouble in time if not corrected. The mixture has its good and its bad points as well.

See If You Can Guess Its Name

Just note that this huge ship is a triplane, that it carries four engines and that tripod landing gear is employed. Now what is it?

IN ITS heyday—which was all too short for such a mammoth among airplanes—this ship was the biggest in the world. Do you recognize it? Turn to Page 298 and see if you were right.

It is worthy of note that triplane construction was employed and that the wing engines were merged into the center wing. It was built in the U.S.A. shortly after the war.

Details of the Short "Kent" Flying Boat

CARRYING fifteen passengers in the luxurious cabin, as well as baggage and two tons of mail and express in the separate holds, the three Short "Kent" flying boats operated by British Imperial Airways in Africa are giving excellent service.

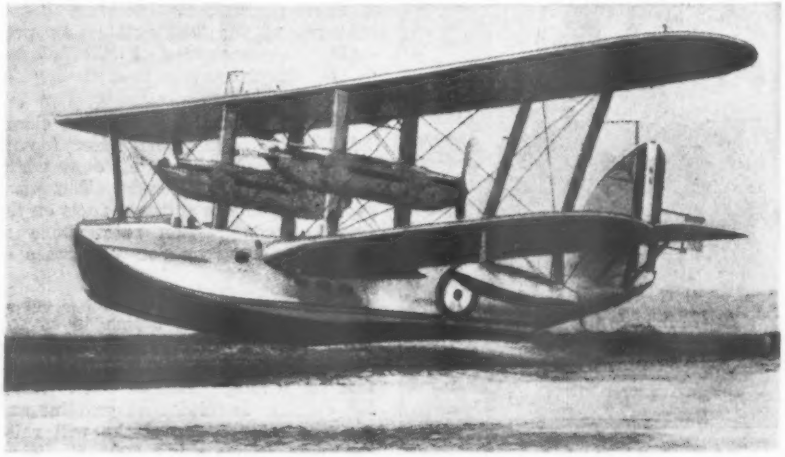
These machines are fitted with four Bristol "Jupiter" engines, each of which delivers 150 h. p. They can almost maintain height on two engines only and have a range of 750 miles at cruising speed—105 m.p.h. Maximum speed is 137 m.p.h.

The "Kent" type of boat is constructed along the usual Short lines, being a biplane with engines between the wings mounted well away from the hull. General dimensions are as follows:

Span . . . . . 113 ft. 0 in.
Length . . . . . 78 ft. 5 in.
Height . . . . . 28 ft. 0 in.
Weight, equipped
but unladen . . . . . 20,460 lbs.
Fully loaded weight. . . . 32,000 lbs.
Ceiling . . . . . 20,000 ft.

The construction is of Duralumin for the greater part, with the notable exception of the underwater surface of the hull which is of stainless steel, so that the machine may operate in tropical waters or remain moored for long periods without risk of corrosion.

The bow of the hull is arranged to form a mooring compartment and the pilots, provided with side-by-side seating and dual control, are placed in an inclosed cockpit immediately behind this compartment. Between the pilots and the hold which accommodates two tons of mail or freight is the radio operator's compartment.



Here is the four-engined Short "Kent" boat just after takeoff. This ship is typically a Short Bros. production.

How to Build the Corben Junior Ace

by O. G. CORBEN

PART II.

And now we begin actual construction of this fine little ship guided by the blue-prints that accompany this article. The wing group is the first job, and this will be followed by the remaining parts in succeeding issues.

HAVING studied the general design of the Corben Junior Ace in the April number, and now being acquainted with its general specifications, we are ready to tackle the actual construction of the ship, beginning with the wing ribs.

All of the details are shown on the accompanying blue-prints together with the necessary dimensions. At first glance this may seem like a long and tedious job—for there are a lot of ribs—but this is not actually the case when you have everything organized and get down to work. If you go about it in the right way, you will find the work very simple and interesting. And further, if you don't understand certain notes on the blue-prints or anything else that comes up in the course of this work, just write to me direct—O. G. Corben, Madison, Wis.

The Corben Junior Ace in flight and being used as a cabin ship. This is a dandy ship, you'll agree, and well worth building.

A Clark "Y" wing section is used for this ship and the edges of the ribs are made to this well known and efficient curve. This section is one of the best all-around airfoils known for this class of ship, and to preserve the efficiency and good flying qualities of the Corben Junior Ace, no liberties should be taken with this section, no matter what your friends may advise you to do. There are a lot of good wing sections, but just remember that the Corben Junior Ace was particularly designed for this airfoil and any experimenting at this point is likely to get you into trouble.

MAKING THE RIB JIG

To start with, a good rib jig or mold should be made. The first step is to lay out a full size pattern of the Clark "Y" airfoil on heavy wrapping paper, making sure that you have drawn a smooth even curve without hollows or bumps, using the dimensions shown on the blue-print.

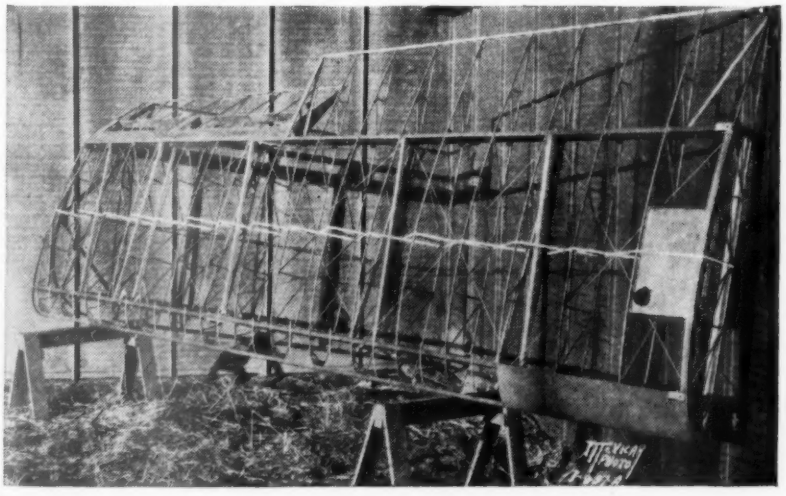
Next, glue the paper pattern to a 1" x 8" x 65" board and then ¼" square strips are nailed around the outline of the rib. Finally, ¼" square strips are nailed down for holding all of the rib braces in place while assembling the ribs.

PURCHASING MATERIALS

I must impress upon you the necessity of purchasing the best of material for building the plane. Second grade stuff is not good enough for this purpose. All of the spruce should be the best clear straight grained stock obtainable. It should be entirely free from sap stains, shaky or open grained spots or similar defects. Similarly, the plywood should be the best quality obtainable to insure against loose plies when the ship is taken out of doors and into moist places. Poor plywood is the source of much trouble—and danger.

Next, but not by any means the least, it is absolutely necessary to use only casein cold water glue of which several brands are available. Casein glues are waterproof and in airplane construction only waterproof glues are permissible. This glue comes in the form of a dry powder and is mixed with cold water according to the directions given on the package. Do not use hide nor fish glues of the type used by cabinet makers, for such glues become soft and fail in the presence of moisture.

It is a good plan to order all of the material necessary for the wing structure before you start working on the wing so that you will not be delayed by a shortage of materials. Second, take care with the work and take your time—especially at the beginning when you are unfamiliar with the work.



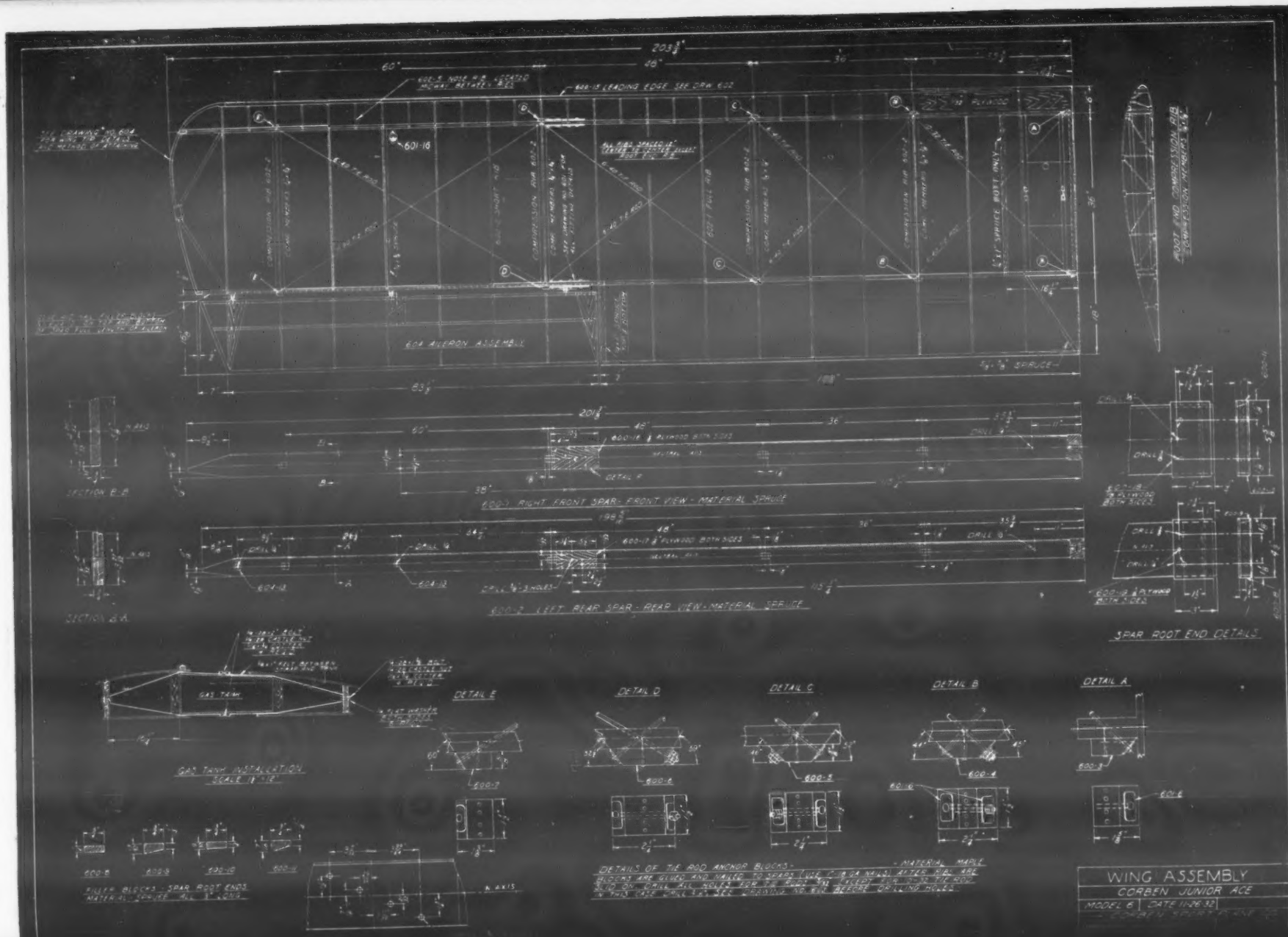
Completed wing structure of the Corben Junior Ace. With care, anyone familiar with tools can easily make a presentable job on this part.

BUILDING THE RIBS

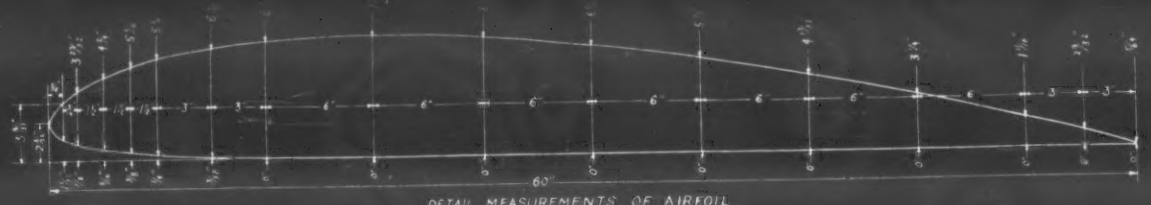
With the materials at hand and the rib jig ready, we will now start making the ribs. Note that the rib consists of two parts, the outer cap strips and the central web.

Next, boil some water in a pail and stand some of the cap strips on end in the hot water to a depth of at least twelve inches, leave the cap strips in the water for at least one hour. After they are thoroughly steamed, take them out and bend them around a form with

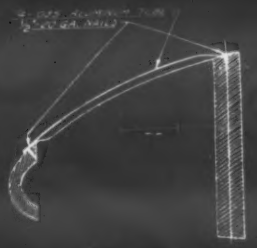
(*Continued on page* 308)


ALL DRAWINGS TO BE FOR WING TO CENTER OF FUSELAGE
ALL NOTED DIMENSIONS
203 3/8"
60"
48"
36"
15 1/2"
600-8 NOSE R.H. CENTER MOUNT DETAILS SEE
600-15 LEADING EDGE SEE DRW. 602
601-16
PLYWOOD
COMPRESSION RIB 602-2
602-1 FULL RIB
COMPRESSION RIB 602-2
COMPRESSION RIB 602-2
1 1/2" SPRUCE ROLL ONLY
ROOT END COMPRESSION RIB
COMPRESSION MEMBERS
602 AILERON ASSEMBLY
5/8 x 1/8" SPRUCE
63 3/8"
109"
201 3/8"
600-1 RIGHT FRONT SPAR - FRONT VIEW - MATERIAL SPRUCE
600-18 PLYWOOD BOTH SIDES
DETAIL F
38"
SECTION E-E
198 3/8"
44 1/2"
DRILL B
600-17 PLYWOOD BOTH SIDES
604-18
604-18
DRILL 3/16 HOLES
115 1/4"
SECTION A-A
600-2 LEFT REAR SPAR - REAR VIEW - MATERIAL SPRUCE
SPAR ROOT END DETAILS
GAS TANK
GAS TANK INSTALLATION
SCALE 1" = 1'0"
DETAIL E
DETAIL D
DETAIL C
DETAIL B
DETAIL A
600-7
600-6
600-5
600-4
600-3
600-8
600-9
600-10
600-11
RIB & BLOCKS - SPAR ROOT ENDS
MATERIAL SPRUCE ALL 1/4" COVE
A AXIS
DETAILS OF TIE ROD ANCHOR BLOCKS - MATERIAL MAPLE
BLOCKS ARE GLUED AND NAILED TO SPARS (USE 1" 8 GA NAILS) AFTER RIB ARE
SET ON. DRILL ALL HOLES FOR TIE RODS IN ASSEMBLY AND REAM TO SIZE
IN THIS CASE HOLE 5/8" SEE DRAWING NO. 604 BEFORE DRILLING HOLES
WING ASSEMBLY
CORBEN JUNIOR ACE
MODEL B | DATE 11-26-32
CORBEN SPORT PLANE CO.
NOTE -
ALL GUSSETS OF
1/2 GAL ALUMINUM TUBE
5/8 x 20 GA. NAILS

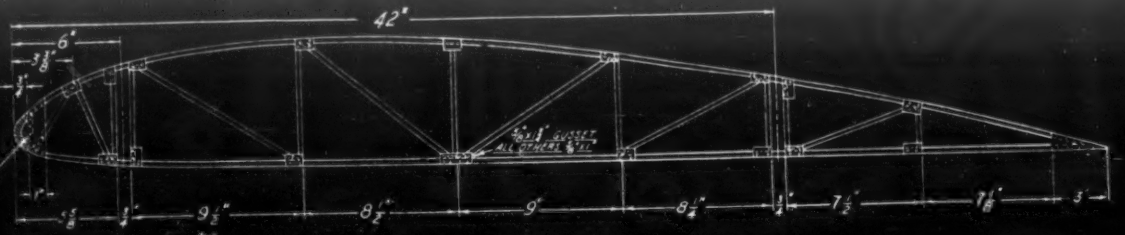
NOTE-
ALL GUSSETS OF
1/32" PLYWOOD NAILED
AND GLUED TO BOTH
SIDES OF RIBS AS
SHOWN.



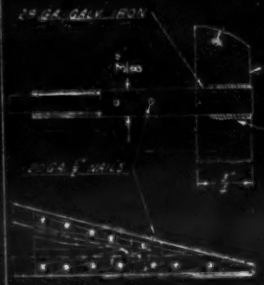
DETAIL MEASUREMENTS OF AIRFOIL



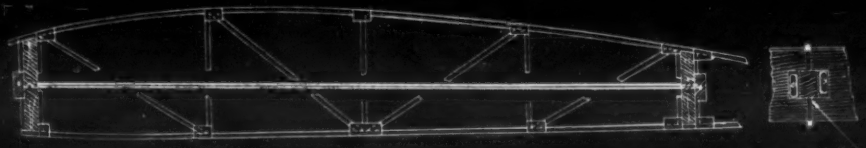
602-5 26 REQ'D
NOSE RIB CONSTRUCTION



DETAIL CONSTRUCTION OF FULL RIB 602-1 20 REQ'D.
CAP STRIPS AND ALL BRACES ARE MADE OF ¼" SPRUCE

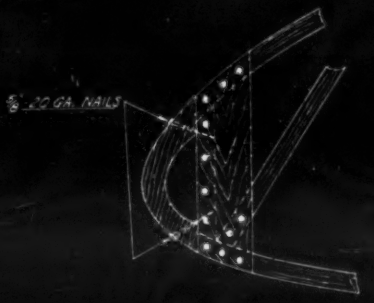


METHOD OF ATTACHING TRAILING EDGE

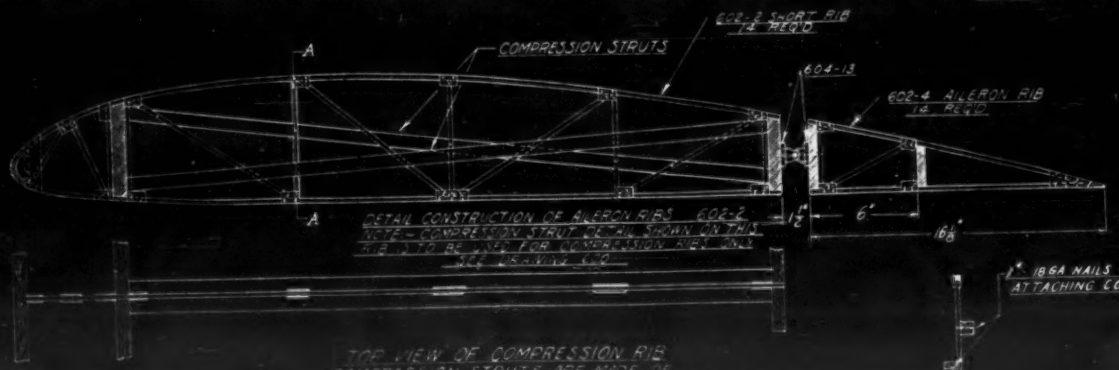


TIE ROD INSTALLATION
NOTE: RIBS MUST BE SO DRILLED THAT TIE RODS CLEAR EACH OTHER AS SHOWN

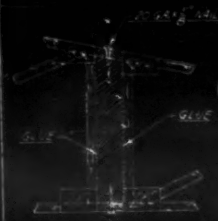
CUT RIB BRACE TO CLEAR TIE ROD BLOCK AND NAIL AS SHOWN



METHOD OF ATTACHING LEADING EDGE



DETAIL CONSTRUCTION OF AILERON RIBS 602-2
NOTE- COMPRESSION STRUT DETAIL SHOWN ON THIS RIB IS TO BE USED FOR COMPRESSION RIBS ONLY
SEE DRAWING 600



METHOD OF ATTACHING RIBS TO SPARS

TOP VIEW OF COMPRESSION RIB
COMPRESSION STRUTS ARE MADE OF
SPRUCE NAILED AND GLUED TO RIB BRACES
SEE DRAWING NO 600 FOR SIZE OF
COMPRESSION MEMBERS.

WING RIBS
CORBEN JUNIOR ACE
MODEL-B DATE 6-23-32
CORBEN SPORT PLANE CO.
MADISON WISCONSIN | 602

Junior Ace

(*Continued from page* 305)

the same curve as that of the wing curve and leave them to dry.

Now take some of the plywood and cut gussets to the sizes and shapes as shown. This may be done with a pair of scissors. Mix up a small quantity of aircraft glue with cold water according to the directions on the package.

When the cap strips are dry, place two of them in the jig with the bent ends toward the leading edge of the rib mold. Cut and fit all of the cross-braces in their proper places, and with a glue brush or small stick, apply a generous amount of glue on each joint where a gusset is shown. It is also well to put glue on the gusset itself before nailing in place.

Next, nail all of the gussets in place as per details. When this is finished, make sure that every gusset is nailed in its proper place, then lift the rib from the jig, turn it over on your work bench and nail and glue gussets on that side so that all joints are fastened on both sides with gussets. Use ¼" x 20 gauge nails for nailing the gussets. After the rib is finished, put it aside and proceed to build the next one in the same manner, and so on, until you have built 20 ribs of this type.

When building the ribs used at the outer end of the wing where the aileron is placed, it will be necessary to make a slight change in the portion of the jig behind the rear spar opening (see detail of rib No. 602-2). Later, when assembling the wing, these ribs are cut off and the rear portions are then used in making up the aileron. Fourteen ribs of this type are required.

THE COMPRESSION RIBS

You will note from the drawing that the compression ribs are made by nailing and gluing two square members to the rib as detailed. Make up four compression ribs, using the main ribs which you have already built. Now make up four more compression ribs from the aileron type ribs which you already have.

As you will note on drawing No. 600, the root end rib also is a compression member only it is of a little different construction than the other compression ribs. It is made up by nailing and gluing two ⅞" square spruce compression members to the inside of the rib as detailed. Do not nail compression members to the outside of this rib as this would interfere when the two wings are butted together in rigging your ship.

After the ribs are dry, they should be trimmed and sanded so that they are smooth on the top and bottom and it is well to sand them in such a manner that the edges are slightly rounded so there will be no sharp edges which may later cut into the covering. Then give them one or two coats of Linoil,

(*Continued on page* 327)

The Bluebird IV by Request of Our Readers

Side elevation of the English Bluebird IV, a lightplane that has proved successful in English flying circles.

THE Blackburn "Bluebird IV" type machine, an English lightplane, is a two-seater light land or seaplane, which has been designed to fulfill private, flying club, instructional and hire service requirements.

The side-by-side seating, originally introduced with this airplane, is retained. Careful body design has included this wide comfortable cockpit without loss of view or performance which favorably compares with any tandem seated machine.

The complete structure, including the wings, is of simple, robust metal construction. It is fully protected against corrosion and is unaffected by climatic variations. The wings, tail and body are fabric covered in the orthodox manner.

Among the many refinements and improvements incorporated in this machine mention is made of the choice offered of any of four different engines. It has an interchangeable chassis so that it may be used as either a land or a seaplane and is provided with folding wings so that the machine occupies the smallest amount of space when stowed. A tail trimming gear is fitted and it has dual controls (either of which may be disconnected) and either seat may be folded up or removed altogether, giving a larger space for extra equipment and allowing free access to the controls. No pulleys are used in the control system nor is a rubber shock absorber employed in the chassis or tail skid.

SPECIFICATIONS

Wing span . . . . . 30 ft. 0 in.
Overall length . . . . . 23 ft. 0 in.
Width, wings folded . . . . 9 ft. 10 in.
Power Plants . . . . . 85 to 120 h. p.

Any of the following engines are recommended: D. H. Gipsy I, D. H. Gipsy II, D. H. Gipsy III or Cirrus Hermes.

Air Corps Develops New Heater System

DESIGNED and developed by Air Corps engineers, a vapor safety heater has attracted an unusual amount of interest during the past few weeks. The heater's main features are a water boiler within an exhaust line and a vapor radiator—somewhat similar to that of an automobile hot water heater—inside the cabin. The arrangement precludes the possibility of drawing poisonous exhaust gases, or heated air contaminated by them, into the plane's interior.

Another important adjunct is the feature which prevents the building up of too much pressure within the radiator or other parts of the system—a danger which might result seriously should it cause rupture or explosion. The safety plan comprises a reservoir directly below the radiator of a capacity equal to that of the water boiler.

The vapor flows through the radiator in the usual manner, leaves the radiator at the bottom, passes through a hand valve and enters the reservoir. The condensed liquid flows through the bottom of the reservoir, through a second valve, and back by gravity into the boiler.

When so much vapor flows through the radiator that it cannot all be condensed and some escapes through a vent hole at the top of the reservoir, the valve is closed, limiting the steam through the radiator and building up pressure in the vapor line. This pressure, rushing back through the boiler, forces liquid through the return line and into the reservoir, thus reducing the amount of liquid in the boiler, and consequently reducing the amount of vapor that may be generated.

Test-Hopping Lightplanes

by LAWRENCE A. CLOUSING

Aeronautical Engineer and Lieut. (j. g.) U. S. N. R.

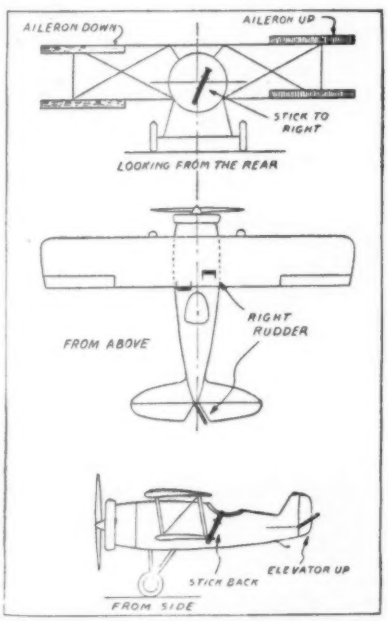
When your lightplane is completed, then comes the test-hop! If you are not in a position to get a professional test pilot, then the author has some important news for you.

WHEN the ship is completed in your shop, you will have most of your thrills facing you. You have built it to the plans, so far as you can determine, and soon will come the breathless moment when the throttle is opened for the take-off.

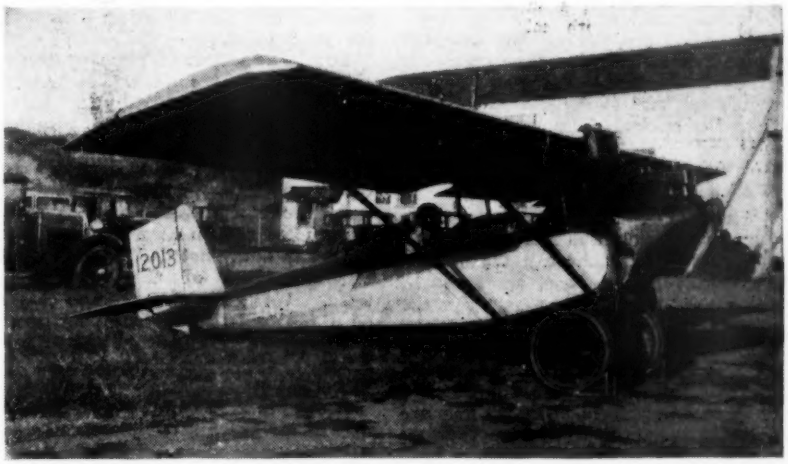
This is the "test-hop," and unless you are an experienced pilot, it is always the best policy to get a good commercial pilot to make this hop for you. In the first place, you might crack up the ship in its infancy if all the adjustments are not perfectly correct to start with, and second, the experienced pilot knows just how it compares with other ships, he can find out what is wrong with your ship and can tell you how to make the corrections. And that is something, take it from me.

You can find experienced men perfectly capable of making a test-hop around any large airport, and very often you will find a pilot who will undertake the job without pay just for the fun of trying the ship. At any rate, even if you must pay him, it is a good investment whatever way you look at it.

But very often, the builder of a homemade lightplane does not live anywhere near a large airport nor can he contact a man who is available for the job. Under such conditions, of course, it will be necessary for the builder to make the test-hop himself,



Positions of the "stick" and rudder bar or pedals with the corresponding positions of the control surfaces. The stick and rudder pedals are indicated by solid black lines.



A lightplane before the test-hop waiting for the engine to warm up. A critical moment in the life of the plane. Will she or will she not?

but this has been done innumerable times even by fellows who had no previous flying experience. And it can be done very successfully if you only go at the job carefully, taking a lot of time and start in by taxying the ship around the field before you attempt a take-off.

Now, assuming that you must test-hop the ship yourself, it is most important to understand that the ship must be very carefully inspected on the ground before any attempt is made to fly it, even low over the ground. If the ship has been knocked down at home, and afterwards reassembled at the field, there is just that much more reason for making this check-up and inspection. Fully 90 per cent of the success of the test-hop depends upon what has been done before the hop is made.

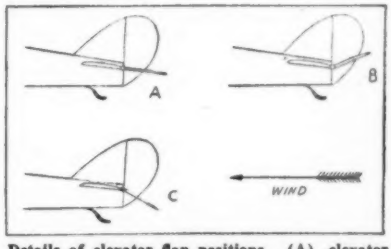
With the ship before you on the ground, what must you watch for when making the check-up? This is a question that will be answered in the following text and should be carefully studied by the beginner.

1. Controls! Make sure your controls work properly; that the cables won't slip off the sheaves; that no connection is loose and that the controls move in the proper direction for a corresponding movement of stick and rudder.

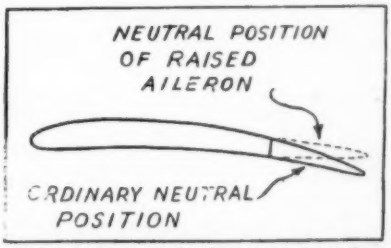
A good rule to remember is that the control surface will always come toward the control that is being moved. That is, with the pilot sitting in his cockpit, moving the stick to the left makes the left aileron come up or towards the stick. A pull back on the stick moves the elevator up and toward the stick. A push on right rudder moves the rudder to the right of the airplane.

Of course, your plane structure should be safe and the weight so distributed that the approximate balance of the plane can be obtained. These are features of design. If they are not OK and you know it, you might as well junk your plane and begin all over again on a design that you know is right.

2. Look to the engine. On your test hop, of all times, you don't want it to quit on you. Make sure it will not overheat. This applies more especially to watercooled engines. Aircooled engines should not easily overheat if



Details of elevator flap positions. (A), elevator flap in normal position for horizontal flight. (B) Flap up, for climbing or leveling off in landing. (C) Flap down. Descent in flight or the proper position when standing on the ground.



Neutral positions of the ailerons as viewed from the ends of the wings. The adjustment of the ailerons is an important matter and attention should be paid to the rigging of these parts.

properly installed. With watercooled engines, particularly lightplanes fitted with Ford and Chevrolet engines, the radiator is often too small. If this is the case, just about the time the plane takes off, the boiling water and steam start blowing from the engine—possibly spraying back on the pilot.

Try your engine at full throttle. Try it on one magneto and then on the other with dual ignition. Try your spark advance and retard and see that the spark advance is sufficient so that maximum power is obtained. Try your ignition switch on "off" to see that it actually stops the engine. The engine mustn't miss and should not knock. Make sure that your engine functions properly in all particulars.

When running your engine on the ground, also observe the revolutions per minute if you have a tachometer. An engine should turn up about 80 per cent of its rated r. p. m. when the plane is chocked on the ground and with the throttle wide open. If it turns up less then you are not getting all the available horsepower out of your engine. If it turns up more you are going to overspeed and injure your engine if you run it full throttle in level flight. The speed depends largely upon the selection of a proper propeller in respect to diameter and pitch.

Almost without saying, you should check fuel lines, oil lines, nuts, bolts, safety wiring, lift and landing wires of the wings and all ordinary details of structure.

3. All right, everything is checked, found OK, and we are ready to fly. We put on helmet and goggles, but no parachute.

"What, no parachute?" you ask, providing you are one of the fortunates who can buy, beg or steal a parachute.

"Nope," on our first flight we are not going to go more than a few feet off the ground and a parachute is of no use then. Then, too, maybe your plane is one of the many overweighted and underpowered lightplanes so often seen around a flying field. No use weighing it down further with a parachute.

On our first flight, we are going to see if the airplane will fly and if it does, what sort of balance it has. We are going to take off, get but a few feet in the air and then set down again before we come to the end of the field. For this purpose we want a large field, one large enough so that we can both take off and land. It should be about 3,000 feet long.

Also, since we have a light airplane, best wait till there is a moderate wind blowing. If there is no wind, the landings and takeoffs will cover too much distance beside being too fast across the ground. High winds make taxying difficult and usually precede gusty air which for a test flight is not so good.

This leads to the subject of taxying a light airplane. If you have brakes on your airplane, you are well off,

(*Continued on page* 328)

Dream-Ships by Our Dreamers

We solicit contributions to this department, so send in a sketch of your ideal ship.

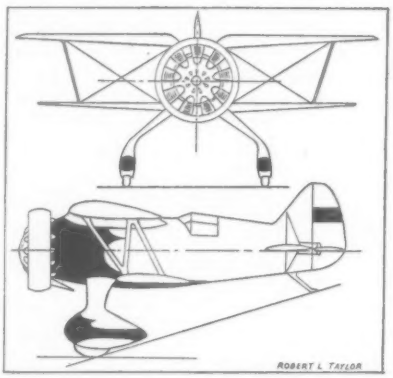
WE hardly need to tell you that our dreamers have been busy dreaming during the past two months. The following drawings speak for themselves, and there are twice as many more in our files awaiting their turn for publication.

But just the same, dreaming dreamships is a mighty useful and interesting indoor sport. It is healthy too, unless our contributors resort to chemical stimulation. Anyhow, it's cheaper than trying to build the dinged things and that's something in these times.

All we're asking for now is something more radical than has been submitted to date—not daffy designs—but something out of the conventional trend. We don't want "cuckoo clocks" as Dan Evers calls them, but something off the Gee-Bee and Benny Howard type that have been so numerous.

Let's say that we all get together and design a light two-place cabin job of the biplane class, or if you have a peeve against biplanes, try your hand at a good monoplane pusher suitable for yourself, your wife and her relations. And don't leave out the bracing for the Mother-in-Law Special. And now, boys, we are all set for some humdingers to appear in the June issue.

Here's a Nifty Dream

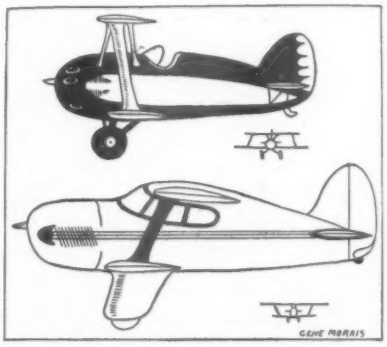


There is sure some tread on this ship, but that's not a bad idea. Quite a nice little biplane, we should say, and very well laid out.

AFTER thrashing about from one pillow to the other, Robert F. Taylor finally went to dreamland with the results shown here. After equipping the vision with one of the new Wasp 700 h. p. engines, Mr. Taylor likes to think that it would bank up around the pylons at about 240 m. p. h.—plus.

Gull wings are used for the top surfaces, and what might well be called a "gull wing landing gear" is also employed which makes me think of one of Larry Lesh's ideas. It should be able to straddle almost anything that it is likely to encounter on the airport or anywhere else. The span is quoted at 20 feet.

Two Dreams Did This!



Morris dreams and here they are. Above is the "Kiwi" a lightplane design of the orthogonal biplane order. Below is a snappy cabin job with two or three yards of engine sticking out in front. And the pants—mmh-mmh!

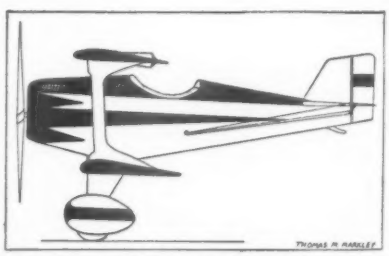
EUGENE W. MORRIS, 1044 N. Emporia St., Wichita, Kan., hadda coupla dreams which he forwarded to us for circulation in Dreamland. Dream No. 1 is the bob-tailed "Kiwi." Dream No. 2 projects the swell cabin job—the "Fleetwing." Annywhoo, they are a pair of mighty nice looking jobs, and Mr. Morris asks for criticisms.

A Collegiate Dreamer

THOMAS M. MARKLEY, a student at Miami University, Oxford, Ohio, uses his room-mate's paper for recording his dream and then apologizes for the paper! This is the height of something or other—I don't know what.

Well, getting back to Mr. Markley's dream, we find a lightplane of the biplane order, equipped with a Harley "61" engine. Probably he has an air-making plant inside the cowl for he has given the outside oxygen little opportunity for entering the engine-room. The span is 12 feet with a fuselage length of 7 feet. He has laid it out admittedly from the little French ship, the "Passepartout" which name, by the way is quite incomplete. It should read, "Passe-out-quick."

However, laying the kidding aside, we might say that this ship contains the germ of an idea, which with more generous dimensions might lead to something.



This is Mr. Markley's contribution to the science of aerodynamics.

What Our Readers Are Building

A department devoted to our readers' activities in airplane, glider and engine construction, showing the latest developments.

Unlicensed Planes Not So Bad

ACCORDING to the reports from the Department of Commerce, accidents due to failure of the wing group are rare. They constitute less than 10 per cent of the total accidents due to structural failures and this shows that a lot of care is being taken nowadays with a vital part of the ship.

Out of five reported accidents due to the wings, four were monoplane wings and one was a biplane cell. Strange to say, the biplane was the oldest of the ships reported which rather backs up our idea of the security with biplane wings. It is said in the report that there was no distinct apparent reason for the biplane failure except that the passengers used it for pulling themselves out of the cockpit and therefore the breakage was probably due to fatigue.

Failures with the monoplanes were due (in one case) to faulty root fittings, in another trouble was caused by insufficient allowance for unsymmetrical wing loading. All were licensed planes with one exception, an unlicensed plane that was equipped with an engine twice as large as the plane was designed for.

Something About Props

FEW amateurs pay much attention to the propellers that they use. If it looks like a prop, on it goes without any further thought, and as usual, the engine gets all of the blame for poor performance.

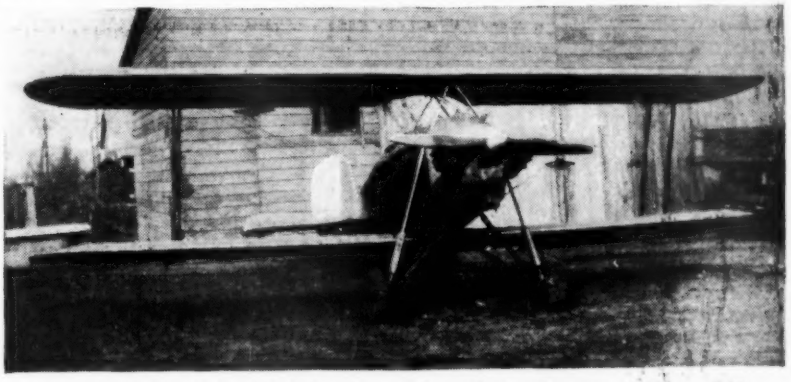
Now the prop is simply a means of transmitting engine power to the air.

The only sure method of telling what prop is best for a given ship is to test out a number and then use the blade that shows the best all around results. If a choice of this sort is not possible, then the only thing left to do is to get a prop that is recommended for that particular engine and let it go at that, although the engine is not the only controlling condition by any means.

First, the shape of the ship's nose affects the performance of the propeller because it influences the slipstream. A prop that is satisfactory for a thin nosed ship may fail utterly on a similar ship having a blunt nose. This, of course, demands experiment. A blunt nosed ship requires a propeller of greater diameter than a thin nosed plane because more of the blade is required to extend out beyond the nose.

The pitch of the propeller must be a compromise between the requirements for speed and for climbing or takeoff. Speed demands a heavy pitch, comparatively speaking, while rapid climb and takeoff require a smaller pitch.

Rose Produces New Light Biplane



A view of the Rose biplane which has shown such excellent performance at Chicago fields.

ONE of the best known pilots in the Chicago District, "Jack" Rose, has recently completed a very fine light biplane which will soon be put into production.

This little ship is not simply the result of a sudden inspiration to build a lightplane, but has been under development for the past two years and all of Mr. Rose's long experience has been incorporated into the design. It is a real lightplane—no question about that—and is a beautiful looking job.

It has a span of 20'-0" and is 16'-0" long with a height of 5'-8". Thus, it is very compact and yet it does not have the failings that are common with short-space planes of this type. It has quite a remarkable stability and steadiness for such a small ship.

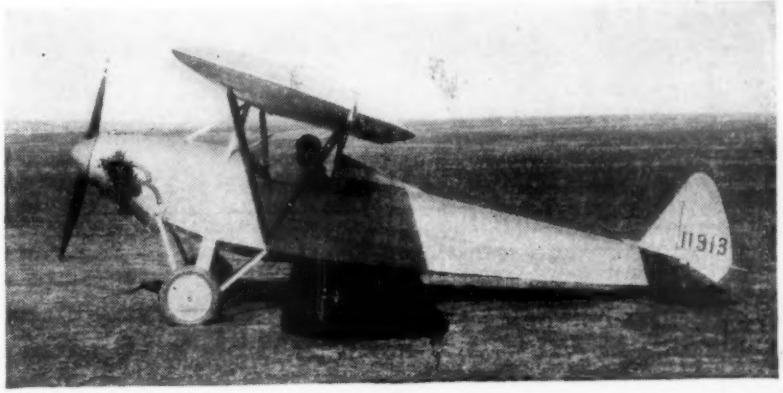
Provided with a Continental A-40 engine, it has a top speed of 107 to 110 m. p. h. with a landing speed of 30-35 m. p. h. by actual test under practical conditions. It will climb at the rate of 900 feet per minute. Economical operation is made possible by careful refinements in design so that it brings the cost of flying down within range of the average man's pocketbook.

Curtis Bradley's Amended Heath Parasol

"IT'S THE sweetest flying little ship that I have flown," says Curtis Bradley of his converted and amended Heath plane. Mr. Curtis who lives in Tulsa, Okla., built the ship from Heath plans with numerous revisions to suit his own particular ideas.

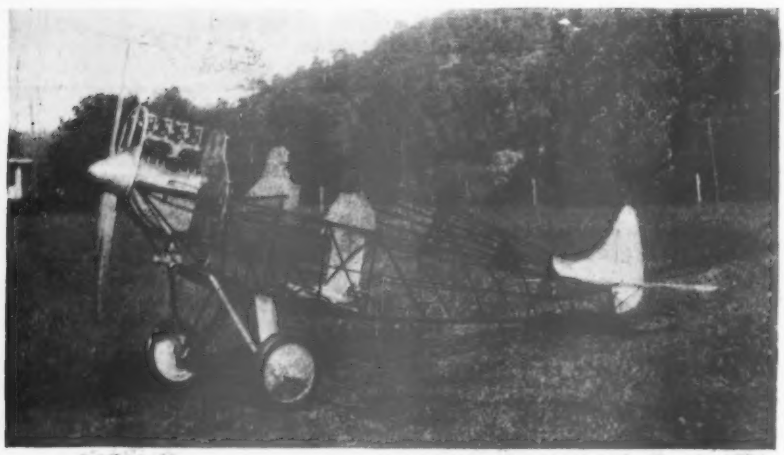
It has a welded steel fuselage and is fitted with a converted Lawrance engine with a special prop. It takes off quickly, climbs rapidly and out-performs a Velie Monocoupe in speed and climb.

He says further, that the State of Oklahoma is cursed with an aircraft law that prohibits flying such craft.



It's a Heath, all right, but some of the Heath features have been exchanged for some personal opinions.

Bartok Builds a Church Monoplane



Here is the Church plane, built by Frank Bartock, just before covering.

FRANK BARTOK, Dillonvale, Ohio, is building a Church Mid-Wing from a Church "Built-Up-Kit" and is making a very creditable job of it. It is powered with a Church Marathon J-3 engine as will be seen from the photograph.

Shortly after this photograph was taken, Mr. Bartock had finished the covering of the wings and tail, and no doubt we will soon hear of the test-hop and successful flights.

This is a clean looking job and Mr. Bartok is to be congratulated upon the excellent workmanship.

Joe Patrick Produces a Ship — and Howls

BY RIGHTS this should go in the Howl Department, but as the letter carries a photo, it has been transferred to Our Readers' Column.

Now, Joseph Patrick, 1645 North 25th Street, East St. Louis, Ill., has a trim little Heath which he bought before the Illinois anti-aircraft laws were passed. It is a welded job throughout and has a special split axle landing gear.

One day the mailman handed him a letter from the Illinois Aeronautic Commission, so he folded up its wings, stored it in a garage and watched the summer roll by without more flying.

To console himself, he cranks up the engine once in a while just to hear it percolate, and dreams of the time when the Illinois Commission will get most of its authority amputated. He'd like to hear from some of the Illinois gang who are tied up in the same way.

However, there may be a silver lining behind the clouds for the Illinois bunch, for the newly elected Governor of Illinois, Judge Horner, came out flat footed and refused to attach his signature to the $40,000 appropriation requested by the commission. And the legislature, then in the throes of an economy campaign, felt the same way about it.

So, there's a sort of sneaking belief that the Illinois commission will be consigned to the junk-pile in the not distant future which gladdens everybody's heart.

Grounded by the Illinois Aero Commission before it had a chance to fly. Now there is a fine chance of the Commission being grounded—for which no one sheds tears.

Estimating Landing and Top Speeds

WE have had so many requests for a simple rule to estimate the top and landing speeds of a proposed airplane design, particularly by our Dream Ship specialists, that we are giving you the simple formula published in the *Air Commerce Bulletin*, Vol. 3, No. 9.

The top speed formula is based upon the fact that the top speed depends upon the ratio of the wing-loading to the power loading.

Let: V=top speed of plane in level flight in m. p. h.

C=an empirical constant (basic).

C1=auxiliary allowances for design modifications such as the form of the fuselage, wing bracing, seaplane floats, etc.

W=wing loading in pounds per square foot.

P=power loading in pounds per horsepower.

Then:

$$V = C\sqrt[3]{W/P} = \text{m. p. h.}$$

The values of constant (C) employed in the formula are as follows:

Biplanes .....C=126

Monoplanes .....C=130

Thus, let us say that a certain biplane is loaded to 6 pounds per square foot and has a power loading of 18 pounds per horsepower. Then, by applying the formula, we have:

$$V = 126 \times \sqrt[3]{6/18} = 126 \times \sqrt[3]{0.333} =$$
$$= 126 \times 0.693 \times 126 = 87.3 \text{ m. p. h.}$$

This is the basic condition for the average plane. However, it can be somewhat modified for the various classes of bracing, types of fuselage, seaplane floats and so-forth. In this case we use the auxiliary coefficient (C1) which increases the basic speed or else reduces it by a few per cent depending upon whether conditions are more or less favorable than the average basic condition. Thus, we have the following modifications:

Cantilever wings.....C1=1.04
Wire Braced wings.....C1=1.04
Monocoque fuselage.....C1=1.04
Round or oval fabric fuselage .....C1=1.02
Retractable chassis.....C1=1.07
Multi-engined planes.....C1=0.95
Seaplanes, flying boats, etc. C1=0.96

Thus: Corrected speed=1.04 x 87.3= 90.7 m. p. h. Using retractable landing gear will help by 7 per cent more, or: Speed = 90.7 x (0.07 x 83.7) = 96.6 m. p. h.

The calculation of the landing speed is somewhat simpler:

Landing speed=$17\sqrt{W} = 17 \times \sqrt{6} =$ 17 x 2.45=41.7 m. p. h.

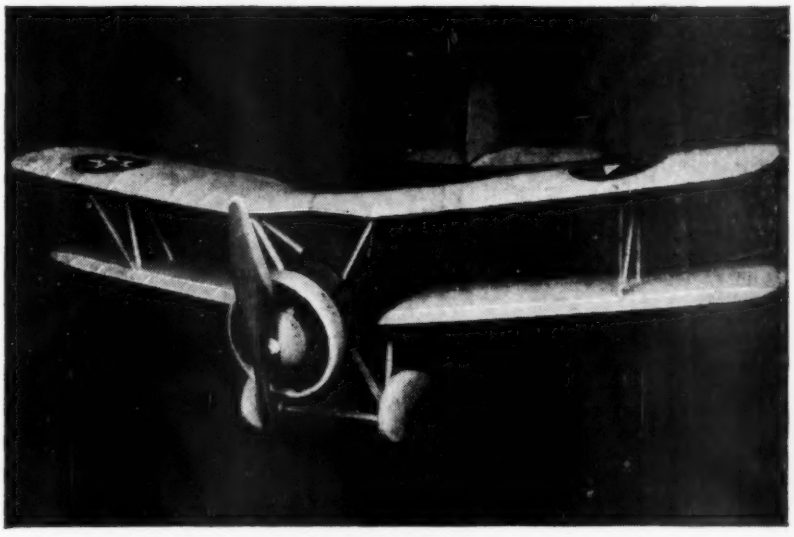
It is not usual to make corrections for the landing speed as this speed is so low that the parasitic resistance of the various structural members has very little effect.

Building the Vought Corsair

by

JOSEPH S. OTT

Model Editor of POPULAR AVIATION



A realistic scale model of the Vought Corsair built from drawings supplied by the Chance Vought Corporation.

THE grand prize for the Popular Aviation First International Model Airplane Contest was won by a Vought Corsair. In the following article, a flying model of the latest type of this machine is illustrated.

This model is the same type used by the United States Navy. The wing span is 20 inches for the full size model, but the drawing is down to half scale. It is a simple matter to lay out the full size plans from the one given with this article. The ribs for the top and lower wing are full size. By using a pair of dividers, and working from a centerline, it is not difficult to multiply all dimensions or parts by two, or by two and one-half which will give a 20-inch or 30-inch wing span model.

BODY—ITS CONSTRUCTION

Make a simple sketch of one side of the fuselage as shown by the double lines on the side view. This sketch should be twice the size of the drawing for a 20-inch model. It is not necessary to sketch more than the outside line, laying the longerons so that all the parts are within the drawing itself. Build two complete sides with all the upright pieces cemented to the longerons and when these are thoroughly dry, fit and cement the cross-pieces to the correct length or twice the dimensions given on the top view (PLAN).

After the top cross-braces have been assembled into their respective positions and allowed to dry, the body formers are drawn, and the balsa parts cut to conform to the pattern, allowing a small margin which can later be sanded to a perfect fit. These formers should be fitted, one at a time, starting with No. 2 and continuing through to No. 8.

The next step on the body is to add the longitudinal fairing strips. Three fairing strips are spaced equally between all the longerons around the entire body circumference. The cockpits are made from thin balsa, a trifle less than 1/32 inch thick. Two separate pieces are required, one for the front cockpit and one for the rear cockpit.

The fairing strips are 1/32 x 1/16 inch in cross-section and each piece is sunk into the former to the proper depth. The tail wheel is made from an extra hard piece of balsa or pine and has a diameter of ⅜ inch. A small piece of wire .024 inch diameter is used as an axle and continues through the wheel and up on each side of the small piece of balsa attached to the underside of the fuselage.

The body has now been completely assembled and is ready to receive the landing gear, motor and tail parts.

RUDDER AND STABILIZER

A full size layout, showing the outside line of the stabilizer is drawn up, around which the bamboo outline is bent. The stabilizer strut is a straight piece of balsa 1/16 x 3/16 inch in cross-section to which the ribs are cemented from the leading edge and trailing edge, meeting at both sides of the spars at which points they are cemented.

The rudder is constructed in a similar fashion, but most of the parts are made of small pieces of balsa. The leading edge continues up over the top and to the trailing edge. This is the only bamboo part. The sizes of materials used in the rudder are the same as those used in the stabilizer.

STRUTS—WING—LANDING GEAR

The wing struts, of which there are two, are made up of ⅛ inch thick balsa and are approximately 3/16 inch wide.

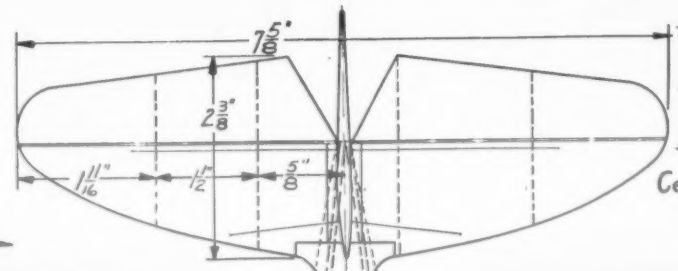
(*Continued on page* 316)

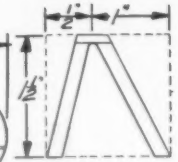
LIST OF MATERIALS

Longerons	1/16 x 1/16 x 18"	8
Spars	3/64 x 3/32 x 18"	4
Trailing Ledge	1/16 x 1/8 x 18"	4
Entering Edge	3/32 x 3/32 x 18"	4
Fairing	1/32 x 1/16 x 18"	10
Bearing Block	3/16 x 2 x 2"	1
Propeller	7½" Diameter	1
Pants—Outside	1/16 x 1½ x 3"	4
Pants—Inside	3/8 x 1½ x 3"	2
Struts—L Gear	1/8 x 1/4 x 18"	1
Struts—Wing	1/8 x 1/4 x 18"	1
Ribs, etc	3/64 x 2½ x 18"	1
Wing Tips	1/32 x 1/16 x 12"	4
Tail Outline	1/32 x 1/16 x 12"	4
Axles	.024" DiDa. x 6"	1
Bearing	Hard Wood	1
Shaft	.024" Dia.	1
Washers	1/8" O. D.	3
Rubber	1/32 x 1/8 x 48"	1
Wheels	1⅜" Dia.	2
Wheel	3/8" Dia.	1
Cement	Clear	1
Banana Liquid	Clear	1
Tissue	Yellow	1
Tissue	Red	½
Windshields	1 x 6"	1
Stars	2" Dia.	4
Dummy Motor	Corks and String	1
Cowl	Cowl—Balsa or Aluminum	1

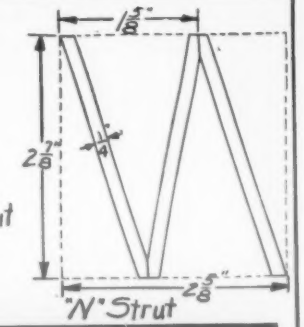
Rib Section - Lower Wing

Rib Section - Top Wing.

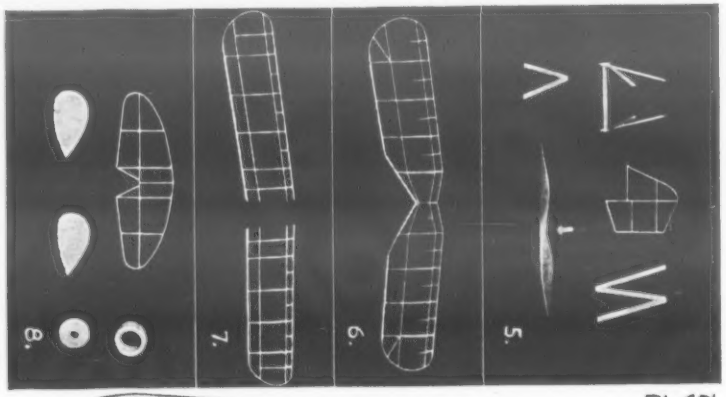




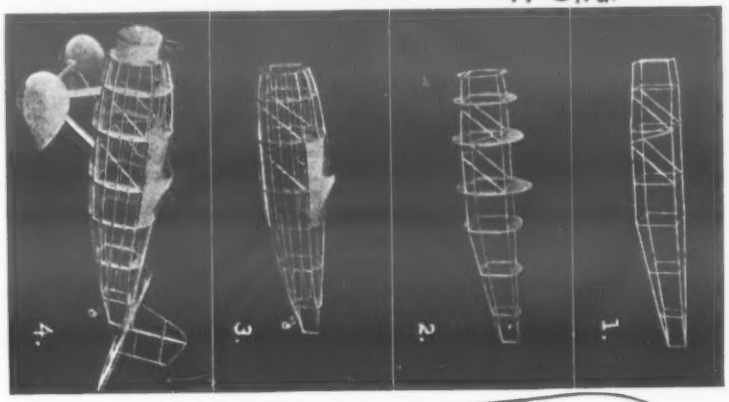
Center Section Strut

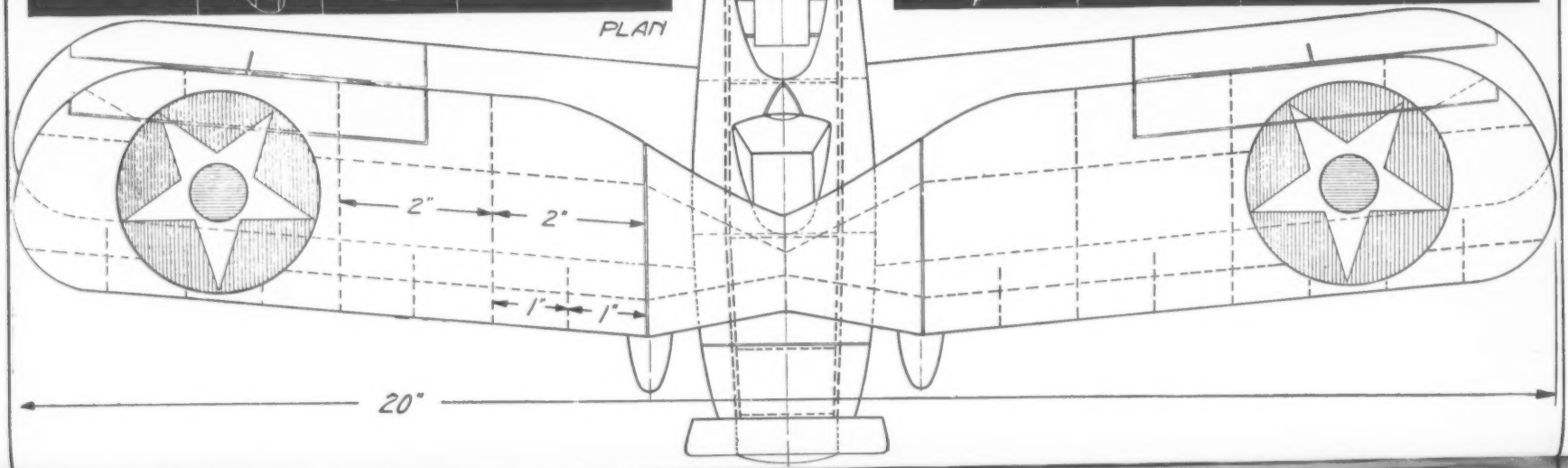


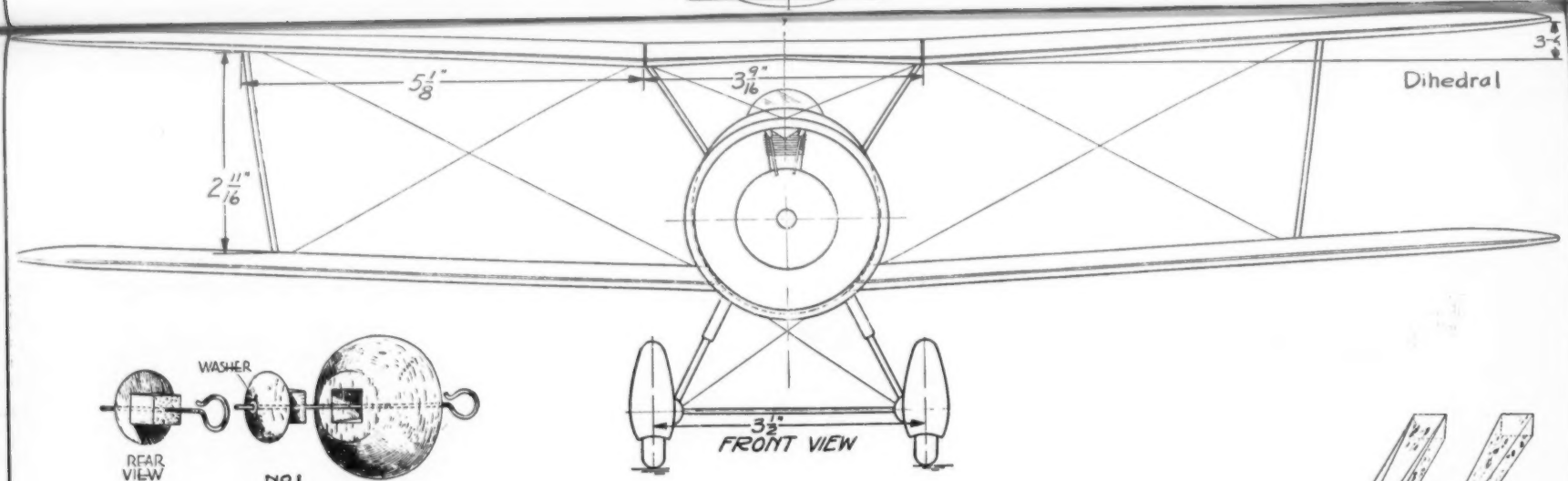
"N" Strut

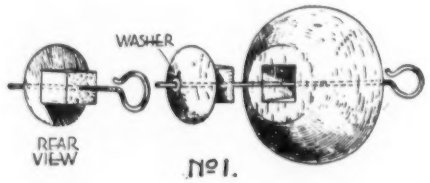


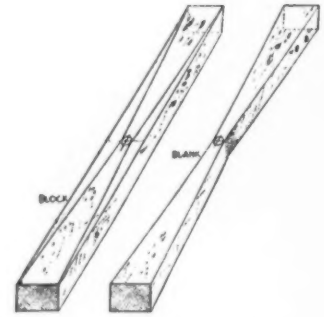
PLAN

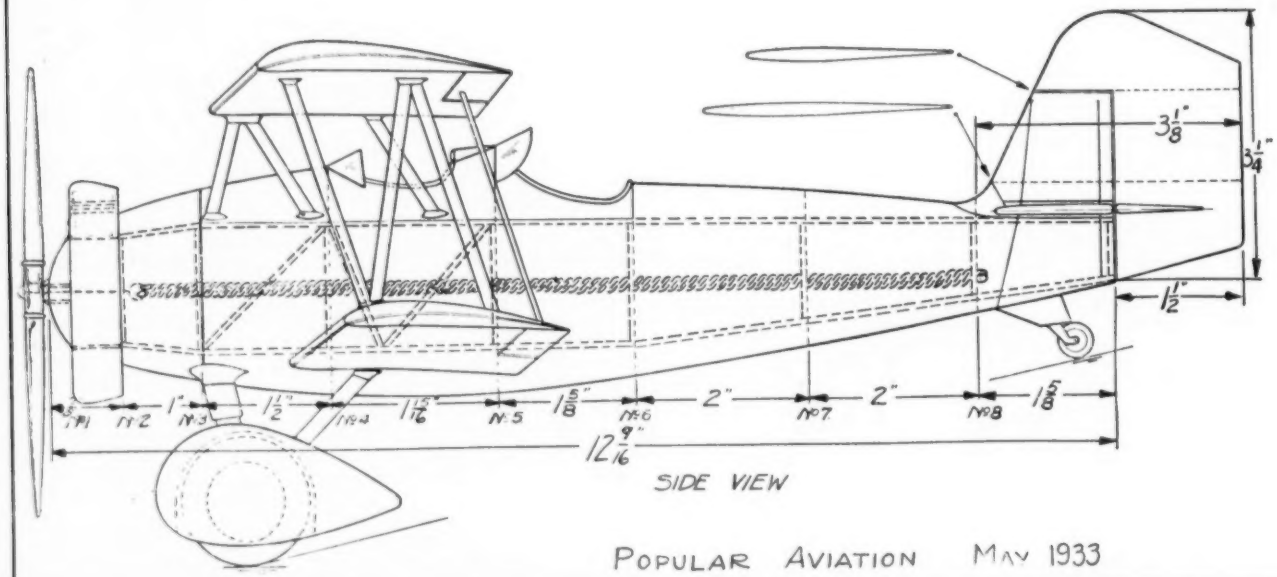


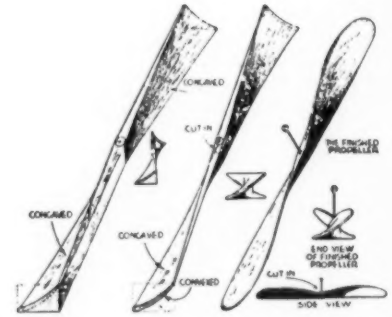












VOUGHT CORSAIR

Vought Corsair

(*Continued from page* 313)

All parts used for these struts should be streamlined before cementing together. The center section struts are of the same size material and the front inverted "V" strut is finished first.

The rear center section strut is added only when the wings are ready to be assembled to the body. The landing gear is built of two separate "V's" with a cross bar taking the place of an axle with two small streamline ends on each side. These small ends may be seen on the front view.

WHEEL PANTS

Two wheel pants are required on this model, although if it is intended primarily as a flying model only, this additional weight should not be added. If the pants are left off the model the axles are bent so that they may be attached to the front upright struts of the landing gear. The construction of the wheel pants is simple if the center part is cut out first and two thin side pieces added, and then when the complete unit is dry, sand it to the proper streamline shape.

CRANKCASE—BEARING BLOCK

The crankcase is a small cylinder reinforced with two rings at the front and rear to which are attached nine separate cylinders. The photograph illustrating the skeleton fuselage clearly shows all of the parts explained in the previous paragraphs. This photograph also clearly shows the position of the crankcase, the bearing block and one cylinder in position. The proper number of cylinders should then be cemented in place around this crankcase.

If the model is intended for flying purposes only, the number of cylinders should be reduced to five or seven instead of the standard number of nine as usually required. The bearing block is attached to the front part of the crankcase and should be made of a very light piece of balsa.

The wood bearing fits into the hole in the center of the bearing block and is removable complete with the propeller shaft and thrust bearing. A washer is cemented to the front of the wooden thrust bearing so that the amount of wobble is minimized.

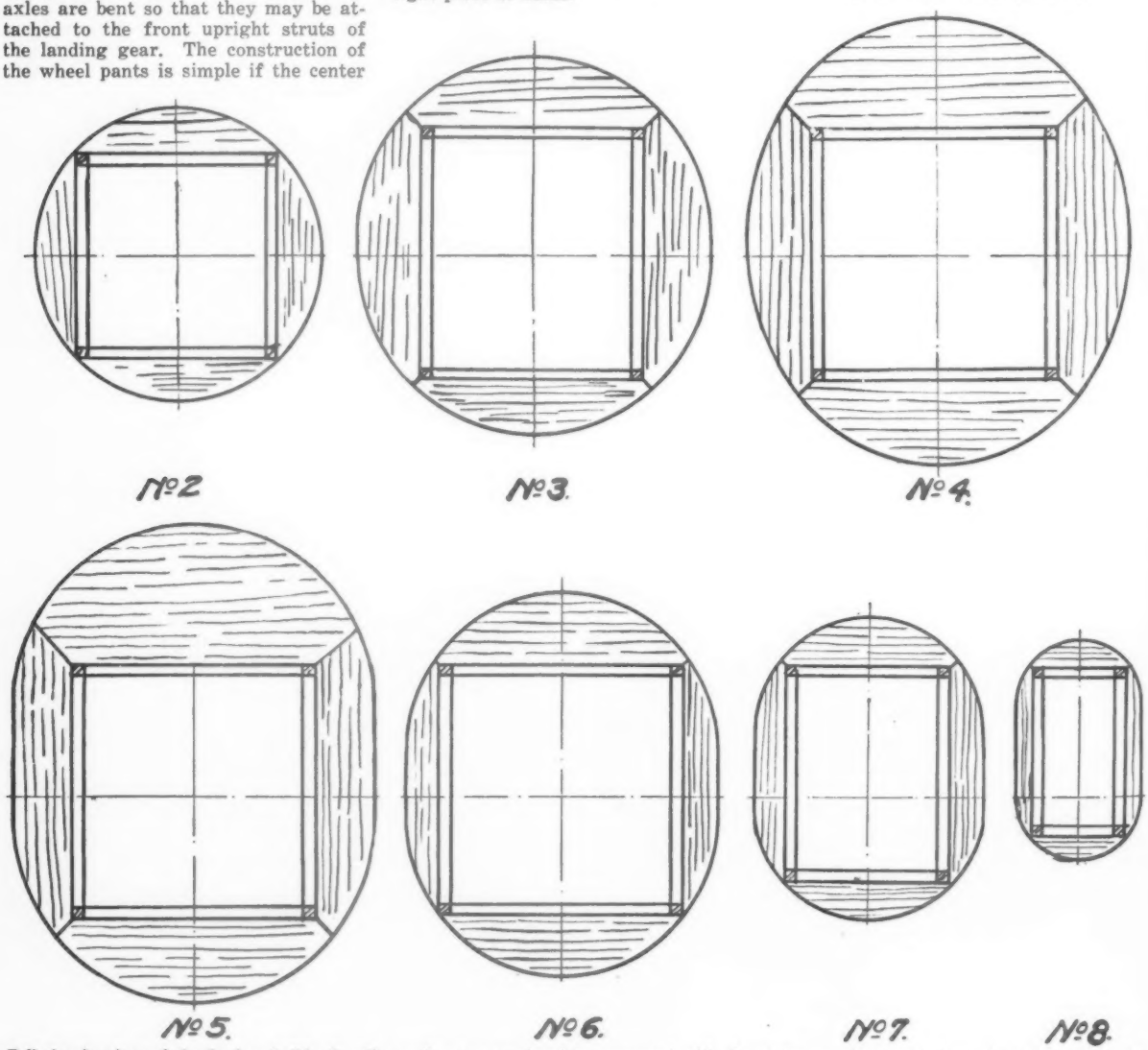
ASSEMBLY OF LANDING GEAR TO BODY

The skeleton photograph of the fuselage shows the correct position and the attachment of the landing gear. Note that the landing gear is attached to the longeron and directly against an upright and crossbrace. The stabilizer remains in one piece and rests flat against the top longeron between station No. 8 and the rudder post. The rudder is cemented on the center rib of the stabilizer and against the rudder post.

WING—TOP

The top wing has two spars 3/64ths x 3/32 inch. The leading edge

(*Concluded on page* 324)



Full size drawings of the fuselage bulkheads. The sections are numbered in agreement with the station numbers marked on the side view of the fuselage on page 315.

With the Model Engine Builders

by JOHN HENRY

Certain of our model fans are now turning their attention to the construction of model airplane engines and show beautifully finished products.

THERE has been a lot of airplane model building, both flying and non-flying scale models, but very little has been done in regard to producing accurate life-like engines. Most model builders have been content with clumsy disfiguring dummy engines built up from wooden rods and cardboard discs, or else they have purchased the ready-made celluloid motors that are not always true to scale or are lacking in many other respects.

Now it is our idea that when a model builder starts out to construct a highly accurate scale model, putting in all sorts of attention to the minor details such as the shock absorbers, pitot tubes and the controls, that such a model is worthy of a much better engine than is generally bestowed upon it. To be very frank, some of the engines that we have seen have disgraced the beautiful work on the plane.

All of these thoughts were in mind when Mr. B. F. Harris strolled into the office the other morning, bearing one of his characteristically well finished models—an engine this time, not a plane. Mr. Harris, you will remember, is the builder of the beautiful model shown in the January issue of P. A. That this is some engine, you will agree after looking at the photograph shown herewith.

This little Wasp engine is one of the most interesting little trinkets that we have seen. It is finely finished and complete down to the last minute detail. Even the bolts and other minor parts

The dummy model of the Wasp engine constructed by Mr. B. F. Harris, Chicago. Complete in every essential detail.

are exactly in the proper place and to scale for Mr. Harris took his dimensions from the original engine. The only things not to scale are the cooling ribs on the cylinders.

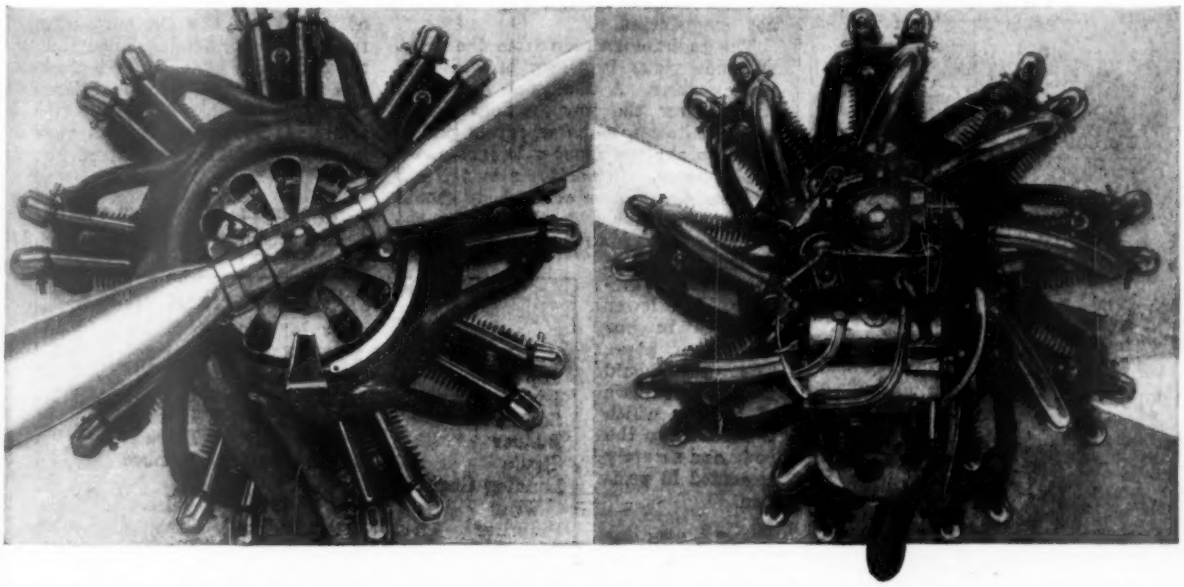
It would have been impractical to scale these parts for they would have been only 1/200 inch thick and not much more widely spaced, making them practically invisible on the finished model. Even the pedestal on which the engine is mounted is a scale copy of that on which the engines are exhibited at shows and schools.

The model is 3 inches in diameter or about one-sixteenth size. The cylinders are lathe turned brass, but the cylinder heads were cast out of soft metal by Mr. Harris himself. The crankcase is an aluminum casting to which the cylinders are attached by bolts. The intake manifolds are of wire solder while the spark-plug "wires" are silk worm gut taken from a fishing tackle. The crankcase is painted gray while the cylinders, pushrods and exhaust manifolds are gloss black.

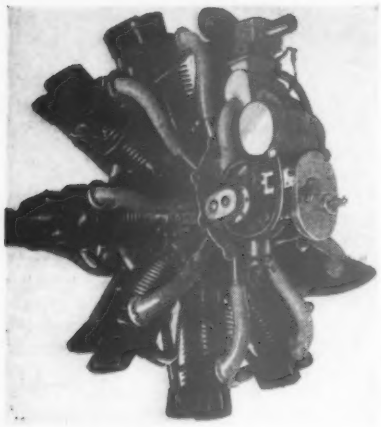
Now, Mr. Harris is much interested in making precise non-flying scale models and during the conversation we learned that he would like to get into touch with other scale model builders who take pleasure in working out details down to a gnat's eyelash. He can be reached at 2000 Lincoln Park West, Chicago, Ill.

Around this office everything seems to work out in pairs or triplets, therefore it did not surprise us much when we heard from another precision engine builder the next day after Mr. Harris visited us. So instead simply of describing one engine, we have made a complete article out of the job and have included the beautiful scale engine models built by Dominick Sala, a watchmaker, who lives in Westerleigh, Staten Island, N. Y.

We show two of Mr. Sala's models which are marvels of workmanship. Every little detail and accessory is



A working model of the Wright "Cyclone" aviation engine which turns over at a speed of about 2,000 r. p. m. Front view at left; at right, rear view of the same engine, showing accessories. This engine was constructed by Dominick Sala, a New York jeweler and is approximately five inches in diameter.

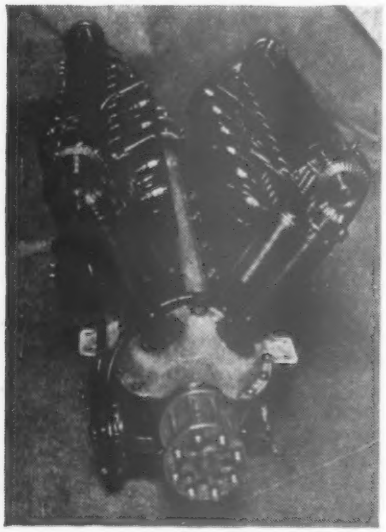


This is a working model of the Wright "Whirlwind" engine built by Dominick Sala.

shown which is only natural because Mr. Sala is a watchmaker with all sorts of diminutive tools at hand.

First of all is Mr. Sala's model of the Wright radial engine of which we show a rear and front view. The rear view shows a wealth of detail, the carbureter, magnetos and all the other intimate parts of this well known engine are included. However, this is really a distinctive model of an engine rather than a dummy model to be used on a model airplane. While it is an excellent model of an engine, as an engine, yet so much refinement is hardly necessary for a dummy engine that is to be mounted on a model plane where most of the parts will be concealed.

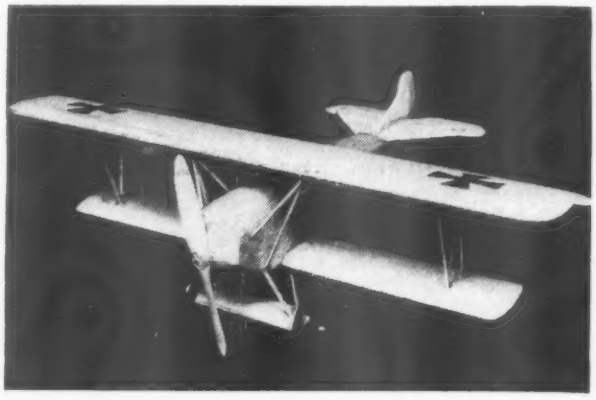
But the most amazing of Mr. Sala's engine models is the model of the 12 cylinder "Vee" type Packard engine which is illustrated here by a front view photo. Note all of the details including the camshaft gears, the oil pump, the spark plugs and the myriad of other parts—true to life. And above all, this engine actually runs according to the builder's statements!



A working model of the Packard aviation engine built by Mr. Sala.

Build This Fokker D-VII Replica Model

by GEORGE HAYDEN



View of the completed Fokker D-VII replica model, one of the most popular ships for model building. An ornament for the den or living room.

THE Fokker DVII was one of the most popular fighting pursuit planes of the Central Powers during the World War and was used extensively at the Front in combat with the French Spads, Nieuports, the English SE-5's and Sopwith Camels.

For those who are collecting the various war time models, this one should be included. The complete model is made from solid balsa and the various parts are cut to shape and sanded to the final required proportions.

SHAPING THE BODY

The first step is to secure all the necessary materials such as the balsa wood, cement, sand paper, wheels, emblems and colored lacquer. The body is the largest and thickest piece and is of a general rectangular shape which makes it easy to cut and form to shape. At the point where the stabilizer sits on top of the body at the rear, a portion equal to the thickness of the stabilizer is cut away.

The cockpit should be drilled to approximately 5/8 inch in diameter and deep enough so that a seat may be added in its proper place. The front of the body on the top is semi-circular from the side and front views. The body at the front bottom has a shape similar to a "V" bottom of a boat, but not exaggerated.

The radiator as seen from the front and side views is drawn in with ink, using a ruler. A small, fine wire mesh will answer the purpose ideally. A small imitation radiator cap is put in place on the top front side just above the radiator. Between stations No. 3 and No. 4, a section of the body should be cut away for a depth equal to the thickness of the lower wing and should fit snugly between the above two stations. The lower wing is in one continuous piece. The skid should be a small piece of bamboo which is forced into the body and securely cemented in position.

SHAPING THE TOP WING

The top wing is 10 inches in length overall between the ends of the aileron. The wing depth or chord is 1 13/16 inches. Note that the thickness of the wing between the center section struts is constant and from each side toward the tips there is a gradual tapering on the upper and lower sides. The wing tips are not pointed but are fairly thick and remain round, conforming to practically a half circle.

The ailerons should be marked out with ink and the scalloped trailing edge is checked with a compass and worked in to appear as shown on the drawing.

SHAPING THE LOWER WING

The lower wing is 7 5/8 inches in length overall and 1 5/16 inches deep. A small part of the leading edge, equalling in length the thickness of the body, is cut away at the point at which it sets into the body. A similar section is cut away at the trailing edge. In this way the wing can be set so that the leading edge is given a slight angle of incidence. The cut out sections in the body should be deep enough so that the lower side of the wing is flush with the body. There are no ailerons on the lower wing. The wing tips are semi-circular from the front view and have a gradual sweep from the top view.

STABILIZER AND RUDDER WITH FIN

The thickness of the rudder is 1/32

LIST OF MATERIALS
For 10" Model

BODY	1 x 1¼ x 7"	Balsa	1
Top Wing	3/16 x 2 x 10½"	Balsa	1
Lower Wing	3/16 x 1⅜ x 8"	Balsa	1
Stabilizer	1/16 x 2⅛ x 3½"	Balsa	1
Rudder	1/32 x 1½ x 2"	Balsa	1
Struts	1/32 x 1/16 x 12"	Bamboo	3
Landing Gear Wing	1/8 x 1 x 1¾"	Balsa	1
Propeller	3½" diameter	Pine	1
Crosses	1¼" diameter	Black	2
Crosses	¾" diameter	Black	2
Wheels	¾" diameter	Red	2

inch and a very firm piece of balsa should be used. The fin and rudder are left in one piece with a line drawn in place to designate the rudder part. The rudder and fin are put in place after the stabilizer and elevator sections have been cemented in their correct position. The stabilizer does not have a flat section on both sides similar to the rudder and fin. The top side has a wing section curve which gives the large machine a lifting stabilizer. The outline of the elevators is marked in a similar way as explained for the rudder.

STRUTS

The struts are very thin and therefore should be made from bamboo. All ends should be forced into the wing and securely cemented in place. Each strut should be formed to a standard streamlined shape. The landing gear should especially be forced into the body.

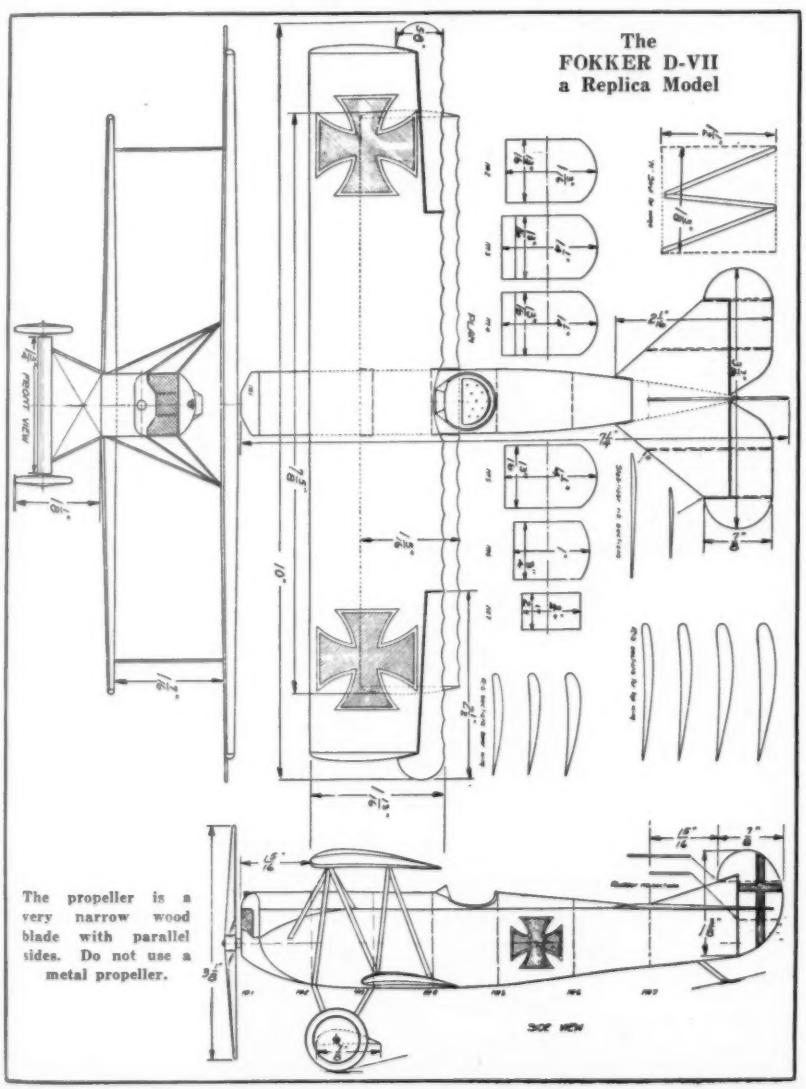
LANDING GEAR WING

A small wing is placed between the wheels and the aerofoil section will be seen on the side view. The axles are straight sections of .024 inch piano wire. They are inserted into each side of the landing gear wing and cemented in position. The wheels are placed on the axles and prevented from coming off by wrapping a small section of thread about the end applying cement at the same time while wrapping.

PROPELLER

The propeller is 3⅛ inches in diameter and should be cut from a piece of pine or bass. Before the model has been completely assembled, each part should be given two or three coats of dope or thick banana liquid.

The model, if left in the natural wood color with just the emblems and the control surfaces outlined, makes a very neat and attractive plane. The most popular schemes for coloring employed on this plane was a camouflage using very drab colors of the following shades, intermingled with a criss-cross pattern, of dark red, dark green, dark brown. A light red body with blue wings and tail make a very neat combination.



The propeller is a very narrow wood blade with parallel sides. Do not use a metal propeller.

Floaters vs. Flyers

by CHAS. P. UNDERWOOD

FOR a long time now, in fact ever since balsa became available to the model builder, we have been facing a peculiar situation. The models have become lighter and lighter until they have almost joined the "lighter-than-air" division, or in other words, we have been simply developing "floaters"—not flyers.

Most of the models of today, weighing less than two ounces, seem to float along lazily on the general principle of a newspaper in a wind or a thistledown caught up in a breeze. This should not be, for to all ordinary purposes, this is not the way that a modern airplane flies nor is such a model at all comparable with a heavily loaded modern plane. The scale flying models are scale models in appearance only, for their performance is entirely different than that of the full size parent of the model.

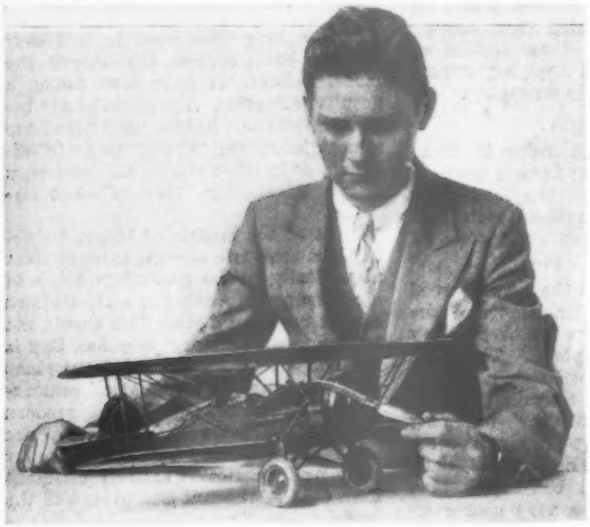
One of the best places to observe this tendency of model building is to attend an outdoor flying contest. The models actually fly distances many times greater than can be accounted for by the size of the motor or the number of prop revolutions. As a matter of fact, many of the long distance flights are due purely to vertical currents of air along the line of flight and have nothing at all to do with the motive power installed in the model. The entrant who is lucky enough to strike a number of "upcomers" has it all over the less fortunate member who gets his models into the "down-comers" or "remous."

This is pure floating or soaring flight and if the meet is to be called a "flying meet" then these conditions should be changed so that the models actually fly and plow through the air just like a heavily loaded full size airplane. To me, it would be a far more satisfactory ending to a contest to have my model actually fly for a few seconds than to have it float around like a balloon for half an hour. Better a few hundred feet of flight than ten miles of blimping.

I believe that the time has come for creating another class of flying models—heavier models that are comparable to full size types. Cut out the balsa in this class and use spruce or other standard woods. Use Dural if necessary, but put up a model that will really show your ability as a constructor of airplanes and not as a builder of pseudo dirigibles. This will take more power—certainly—but it will be more of a test of your skill and knowledge of aerodynamics. Building floaters is not an art.

And then, when you have put up a 24 ounce or 30 ounce model, just as the English are doing and make this model fly for a respectable distance, you will know that you have actually accomplished something really worth while and something to be proud of. You can do it if you try. You have accomplished a lot with balsa—now try something else for a while.

Champion Geigan Becomes a Public Figure



A closeup view of Joseph Geigan, winner of the Grand Prize, and one of his earlier models.

JOSEPH GEIGAN, winner of the Grand Prize in the recent model contest held by POPULAR AVIATION, is being hailed as the world's premier model builder by his many admiring friends. He has been the recipient of much publicity since the model contest and many compliments have been paid to him on his achievement.

First of all, he encountered our old friend and contributor, T-2003, at the Smithsonian Institution, who took a great liking for the lad. Later, Geigan received the compliments and good wishes of Dr. Paul Garber, Curator of the Aeronautics department of the Smithsonian Institution.

And finally, our champion has received a fine letter from E. E. Wilson, President of the Chance Vought Corporation, builders of the "Corsair" from which Geigan received his inspiration for the model. We are very glad that so much attention has been paid to the winner of this contest for he richly deserves his eminence.

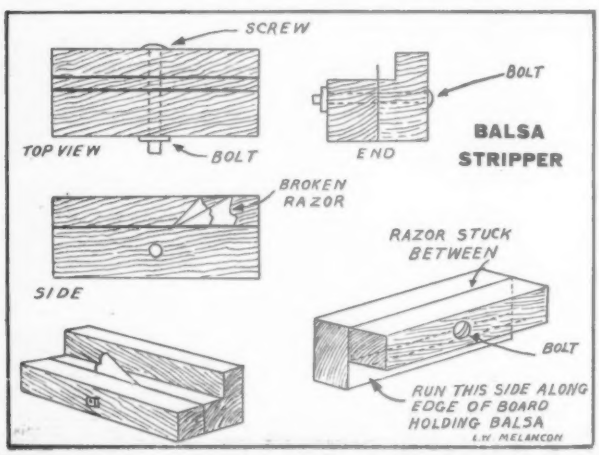
So, just to let you see what he looks like, we are printing the accompanying closeup of Geigan and his model—a better picture than the hazy snapshot printed in our last issue. We hope that you will meet him in Baltimore where he and prize winner Barry are making personal appearances. The leaders of the various divisions in our contest will be exhibited under the sponsorship of the Baltimore Post.

We hope, therefore, that the Champion will enter our next contest with another example of his excellent workmanship and pit it against a new field of contestants.

Here's How to Make a Balsa Stripper

L. N. MELANCON, 504 Auburn Ave., Monroe, La., has submitted an interesting idea that will prove very useful to the model builder as a tool and at the same time will solve the problem of getting rid of old razor blades.

A hole is drilled through a 3/8 inch square piece of pine, and then a 1/4 inch step is cut into a second piece of 3/8 x 13/16 inch pine. A hole is then drilled through the side and a 1/8 inch screw is pushed through this hole. An old razor blade is then put in, afterwards putting on the other side and screwing the parts together as tightly as possible.



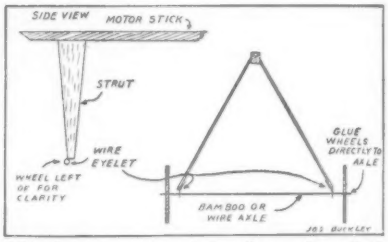
This device will cut balsa strips smoothly and cleanly with very little labor and should therefore find a place in the tool kit of every model builder. The tool is simple and can be made from materials found around any home.

Mr. Melancon asks, "Who is Pop Stick"? Well, this has been a dark secret to date, but we will whisper in your ear that Pop Stick is Santa Claus' brother-in-law!

Making Smooth Running Wheels

JOE BUCKLEY, 3461 Jasper St., Philadelphia, Pa., has a new stunt for getting smooth running wheels, a problem that you all have studied from time to time.

He attaches a wire eyelet or thrust bearing to the strut for a bearing, running the axle through the eyelet. The wheels are glued directly on the axle. This makes an easy running landing gear for R. O. G. models and is well to consider.



This is one way to get smooth running wheels for an R. O. G. model, using a bamboo axle.

Model Wind Tunnels

WHILE few model builders have tried designing models and then testing them in home-made wind-tunnels, it is a real indoor sport. By using a wind-tunnel for making tests, you can learn a whole lot about the action of wings and the effects of head resistance —much more than is possible by simply test-hopping the models.

And after you have been working with the wind-tunnel for a while, you will find that you can actually design a model with a very good idea of its performance and in this way can beat the other fellows to it when it comes to contests. And, if you intend to take up aeronautics in earnest, later on, you will find that this simple little tunnel will have taught you a whole lot of things about aerodynamics that will be of value when you enter into actual full scale design.

Next Year's Model Contest

NOW that the big 1933 model contest is over, we turn our thoughts to the Second Annual International Airplane Model Contest.

It will undoubtedly be much larger than the first contest and will attract more public attention. Guided by our experience with the first contest, the Flying-Stick division will probably be dropped and only the Flying-Scale Model, Non-Flying Scale Model and the Freak Divisions will be maintained.

So this is just a gentle hint for our model builders to start getting the entries ready for the next contest.

◆ BARTER AND EXCHANGE ◆

Good Opportunities for Our Swappers

This service is free to all of our readers, but the publishers reserve the right to reject any or all notices that are not in accord with the policy of this magazine. Only trades or "swaps" will be permitted. For cash deals, buying or selling, refer to our Buyer's Directory. Readers are urged to use caution in arranging trades and references should be mutually exchanged.

AIRPLANES

HEATH PARASOL with welded fuselage, Henderson engine, an extra wing, propeller, complete. Also have one-step hydroplane, 12-footer, with or without engine. Will trade for a Pietenpol, or any two-place ship in good condition with or without engine. What have you got?—V. E. Poland, 1202 Grand Ave., Washington, Ind.

OX-5 AMERICAN EAGLE, 3-place dual control. Will trade for a Monocoupe, 2-place Eaglet, 2-place Aeronca or similar factory built 2-place job. Eagle in excellent condition with 165 hours total time. Will also trade one pair of 26x4 wheels, tires and tubes for a pair of 20x4 wheels or air-wheels for a light job. Let me hear from you.—E. L. Zastrow, Portage, Wis.

LIGHTPLANE, Wing span 34 feet, Heath-Henderson engine, 20x4 tires and wheels, 1-place job, wood fuselage. This ship has been flown about 15 hours during the past summer. Needs some repairs to the tail group. Will trade for vending equipment such as slot machines, small scales, peanut machines, etc. Can send photo.—R. A. Hibbard, Route 10, Kalamazoo, Mich.

SPORT BIPLANE, 2-place job, powered with a Hisso engine. Will trade for a good automobile.—Arthur E. Brand, Bismarck, N. Dak.

HEATH PARASOL, not licensed but in good condition. Excellent Henderson engine, steel tube fuselage. Will trade for a modern motorcycle, automobile or a good metal lathe.—O. J. Harsch, 501 W. Central Ave. S., Williamsport, Pa.

HEATH PARASOL in No. 1 condition with only 45 hours on it. Powered with a Heath-Henderson engine. Will trade for a damaged 2-place job.—B. Wazier (Nozier), Hamburg, Ill.

WACO "9" with OX-5, 3-place open job. Ship and engine in excellent condition, a real performer. Will trade it for a 2-place ship with radial engine, either a monoplane or biplane. An Eaglet will not be considered. What have you?—Page and Gammon, Mechanicsville, Va.

LIGHTPLANE WANTED, must be in fair flying condition. Steel or wood fuselage. Will trade in a $70, 1931 Bosch 5-tube auto radio complete, an Arvin $35 auto heater, a $27 Victrola, one fine Uke, Henderson engine complete with propeller shaft, a 30 inch model of Doolittle's 1932 ship.—Jack Nogrody, 437 E. Myrtle Ave., Youngstown, Ohio.

BIPLANE WANTED, 2-place, O. C. job with folding wings preferred. Will also consider a 2-place cabin job. What do you want?—S. Cordellin, 34-33 9th St., Long Island City, N. Y.

HEATH PARASOL, MODEL V., complete with welded fuselage and special Heath-Henderson engine. Also have Velie prop, new 20x4 wheels and tires. Will trade a wrecked Curtiss Robin or what have you?—Harvey Christensen, 221 Stanton Ave., Ames, Iowa.

AIRPLANE PARTS SUPPLIES—PLANS

CLARKE "Y" MOLD wanted. What do you want in trade?—Z. Sajkowicz, 22 Howard St., Norwich, Conn.

PROPELLERS. Have 4'-6",5'-0" and 6'-0" props to trade for radio, motor, aviation books or what have you?—C. C. Holden, 2826 Vickery Blvd., Fort Worth, Tex.

USED HEATH-HENDERSON PROPELLER wanted. Will trade in one ½ h.p. electric motor, 1150 r.p.m.—George Groffumler, 307 S. Minnesota St., New Ulm, Minn.

FORD PROPELLER wanted, 6 foot diam., also a set of 16x7 air wheels. Have numerous things to offer. What do you want?—A. E. Ensworth, 252 Landis Ave., Vineland, N. J.

HEATH FUSELAGE, bolted type with tail. Covered. Has control unit, seat, landing gear (without wheels). Will trade for a lightplane in good condition and will pay $100 to boot.—L. D. Jacob, R. D. No. 3, Wellsburg, W. Va.

LIGHTPLANE PARTS and engine wanted. What do you want in exchange?—Bill Goff, 16 Prospect St., Weymouth, Mass.

DRAWINGS and data on the Pischoff or Irwin lightplanes wanted. Will trade or pay for these drawings. What do you want?—Emerson Walker, 824 South Thompkins St., Shelbyville, Ind.

ALCO CABIN FUSELAGE with door, instrument board, stick, rudder bar, tail skid, two wing spars and set of Alco blueprints. Cabin completely finished with floor, covering, seat, etc. Will trade for a small piano accordion, or what have you got to offer?—J. LaVender, Box 658, Oak Hill, W. Va.

GUARDIAN LIGHTPLANE and monoplane glider plans with rib mold, Maytag and Harley engines, Scroll saw, Tenor banjo, Correspondence course, 100 Air fiction magazines. Will swap for shock cord, Dynamic speaker, 50 watt tube, Shotgun, Rifle, Motorcycle saddle bags, or what have you?—Edgar Kamrath, Radio W9HDL, Juneau, Wis.

LIGHTPLANE PARTS, 24 ribs, ailerons half finished, complete tail group, stabilizer, elevators, rudder and fin with cover. Will swap for a 20-inch flying scale model of the new Curtiss Hawk P-6E completely finished. Must show good workmanship and be an attractive paint job for a display window. What have you? Harry Lawlor, 2711 Chippewa St., Flint, Mich.

AIRPLANE WHEELS, complete set of second-hand airplane wheels wanted, spoke type, good tires. Also wish the landing gear struts and axle to be used for a Puss Moth cabin. Wish 10 complete control horns with good control wires, stick and rudder bar. What do you want? Herbert E. Kipp, 918 Buss Ave., Benton Harbor, Mich.

PROPELLER WANTED, a 4'-6" cloth tipped or metal tipped in wood or all metal. New or slightly used in good condition. Will trade anything in the airplane line, model airplane line, sporting goods or goggles.—F. J. Wasch, 3861 Ashland Ave., St. Louis, Mo.

WACO "9" FUSELAGE, new and complete with dual controls. All it needs is covering and cowling. What have you to trade?—Page and Gammon, Mechanicsville, Va.

WOOD FUSELAGE, 13'-6" long, also several homemade bubble sextants. Want 4-cylinder magneto, a 6'-0" diam., 3'-6" pitch propeller or what have you along this line?—Edgar Lesher, Jr., 92 E. Framber Ave., Columbus, Ohio.

PROPELLER WANTED, 6'-0" diam., or larger, to be used as an ornament. Must be in fair condition. Will trade a model of the Darmstadt "Edith" glider, span five feet, or magician's tricks to the same value as the prop. What would you prefer?—Lloyd LaPlante, 4553 Harriet Ave. S., Minneapolis, Minn.

SIMPLEX RIGHT WING PANEL, for Simplex low wing monoplane and one Bosch 4-cylinder magneto, triple magnets, heavy duty. Will trade for Pietenpol Air Camper wing and fuselage parts. What have you to trade?—Andrew J. Saliga, R. F. D. 2, Box 38, Clarksburg, W. Va.

22 x 10 GOODYEAR AIRWHEELS, six complete wheels, will trade for a Pietenpol Ford "A" converted engine or other engine suitable for the Air Camper. Will also trade one pair of wheels for wing parts, instruments, propeller, etc., for the same ship.—D. M. Eberome, 427 Michigan Ave., Monroe, Mich.

COMPLETE BLUEPRINTS for Lincoln Sportplane, Lincoln Monoplane, Dixie Monoplane, Alco Monoplane and Irwin M-T Meteorplane. I have all the POPULAR AVIATION articles by Ed Heath on building the Heath Parasol. Also have the Marshall Stillman Boxing Course and a pair of Sesco Welder's goggles. This material is worth about $60 and I will trade it all for a Heath-Henderson engine. I also want a pair of 20 x 4 tires and tubes. What do you want?—William Cronin, 1719 Francis Ave., Houston, Texas.

AUTOMOBILES

1931 CHEVROLET COACH. "Deluxe," two new side mounts with metal tire covers, radiator grill, trunk rack. Only 8,000 miles on the car and in new car condition. Want OX-5 Bird or similar plane in A1 shape. A. W. Cowgill, Box 243, Rio, Wis.

FRONTY DIRT TRACK RACER parts wanted, including one-man body and engine. Have a set of overhead valves, 1926 Harley 74 and several new airplane instruments to exchange.—Samuel Mooskian, 180 School St., Jamaica Plain, Mass.

1930 PONTIAC COUPE. Has 19,000 miles, original tires just replaced by new. In clean condition. Will trade for any 3-place OX-5 job in good condition, licensed or in condition to license. Will also consider a lightplane with some cash.—L. N. Childress, Box 53, Dumas, Tex.

1931 FORD SPORT ROADSTER, 12,000 miles, perfect condition, to trade for any licensed ship. Cash difference if the plane is worth it. What have you?—Robert G. Johnston, 1505 10th St., Tuscaloosa, Ala.

1930 FORD COUPE in good shape. Will trade for a 2-place ship suitable for training. Must be licensed or capable of being licensed. Will pay cash difference within limits.—Robert Gunderson, Highmore, S. Dak.

MODEL "A" FORD, Sport Coupe with low mileage and in A1 shape. Will trade for a 2-place lightplane, in good condition or slightly damaged. Prefer a ship eligible for a license or eligible for license with only a few repairs. What kind have you?—Henry F. Cordes, Box 2, Hayward, Garfield Co., Okla.

1926 CHRYSLER RACER in good condition, Model 58, 4-cyl., four-wheel brakes, two new tires. Will trade for a motorcycle, 2-cyl. type, not older than 1926.—John Stopka, Pinconning, Mich.

BOOKS AND MAGAZINES

RED KNIGHTS OF GERMANY by Floyd Gibbons. Will trade for 1930-31-32 Flying and Glider Manuals, photos of army planes, speed planes, or what have you.—Leo Russell, 2138 Newburn Dr., 16, Pittsburgh, Pa.

MODERN AVIATION ENGINES by Victor Page, Vol. 1. Will exchange for book on meteorology of equal value or what have you?—J. J. Platt, 281 Villeneuve St., West, Montreal, Que., Canada.

OVER 400 MAGAZINES and 12 books, all on aviation. Such magazines as POPULAR AVIATION (26), Aviation (60), Aero Digest (28), Airway Age (12), Model Airplane News (14), Western Flying (12), Sportsman Pilot (13), Modern Mechanics (26), Popular Mechanics (160), Government technical memos are included. The books are the latest and this is a perfect library for a school. I want a lightplane or what have you?—Clegg Bauve, New Iberia, La.

A-B-C OF AVIATION by Victor Page and the first edition of the Aircraft Mechanic's Handbook by Colvin. Will trade for other airplane books or airplane photos.—George Boucher, 48 French Ave., East Haven, Conn.

LaSALLE LAW BOOKS, correspondence course with 15 vols., worth $40. Also candy course. Will trade for a typewriter, guns or binoculars.—Jimmie W. Holdes, Rt. A, Lamesa, Tex.

POPULAR AVIATION copies wanted. Back issues April 1932, June 1932 and August 1932.—Weldon Clifton, Route 6, Sulphur Springs, Tex.

POPULAR AVIATION, 1932 file complete, also odd issues of 1930-31. Will trade for model airplane supplies.—Lester Pardini, 1126 Altgeld St., Chicago, Ill.

AERO MAGAZINES, cost $14, to trade for a good pair of goggles, winter helmet, or what have you?—Howard Juick, 57 2nd St., Walden, N. J.

BACK NUMBERS of Aero Digest and POPULAR AVIATION to trade for solid scale model with a 10 inch or larger span. Prefer one with a radial engine. Please send a 3-view sketch or picture of model and state number of magazines wanted.—Paul Kyle, 210 N. Second Ave., Washington, Iowa.

BACK NUMBERS of Aero Digest, POPULAR AVIATION, Model Airplane News, National Airplane and Glider Magazine, Lightplane Manual. Will exchange for a scale model not less than 24 inch span, preferably a DeHavilland.—Ignazio Polizzotto, 340 N. 10th St., Newark, N. J.

BOOKS. I want to trade $250 worth of books and a ground school course in aviation for a light car or what have you? Here are a few examples. Dyke's Aircraft Engine Instructor, Air Navigation and Meteorology, M. A. N. Diesel Engine Books.—Henry Orloff, 211 E. 159th St., Harvey, Ill.

BOOKS AND MAGAZINES. Issues of Aviation from 1922 to 1926, also copies of Aero Digest, and many issues of POPULAR AVIATION. The books include: Sportplane Constructor and Prints, by Russell, Aeroplane Construction and Operation, Building and Flying an Airplane, Harpers Aircraft Book, Guardian Lightplane Prints. Want lightplane, crashed but repair-

XUM

able, good used instruments, lightplane parts or anything that I can use.—A. W. Hurd, R. F. D. 2, Kingman, Kan.

PRACTICAL FLYING by Byron O. Jones, new. Cost $3.00. Will trade for a model airplane—a 24 inch Curtiss Super-Hawk. Would like to trade with someone in Calif.—Carl P. Clement, 136 No. L St., Tulare, Calif.

BOOKS AND MAGAZINES. Beginner's Book of Model Airplanes, How to Get Into the U. S. Air Corps. National Geographic Magazine, 1918, full of data on wartime aviation, 100 Western magazines, 37 vol. course in aviation. What have you to trade?—Joe Michaels, New Hampton, Orange Co., N. Y.

MAGAZINES WANTED. Will trade a battery charger for 12 issues of POPULAR AVIATION, Popular Science or QST. I also have several issues of Popular Mechanics that I will trade for the above magazines.—John Knaul, 7360 Kirkwood Lane, Fernbank, Cincinnati, Ohio.

MAGAZINES. I have 25 copies of POPULAR AVIATION including a complete file from August 1930 to November 1931 inclusive. Also 6 issues of Aero Digest, 3 issues of National Glider and Airplane News and one issue of Aviation. Also an Ellington Field Yearbook for 1918. Prefer to trade for radio equipment and textbooks. Want especially, Jan. and Feb. issues of QST.—R. B. Rosenberg, 1013 Fourth St., S. W., Canton, Ohio.

CAMERAS—MOVIE PROJECTORS—FILM

KEYSTONE MOVIE PROJECTOR, no motor, with 3,000 feet of film. Also one set of 4 vols., Boy Mechanic's books, brand new. One single-shot, bolt action Springfield rifle, takes 0.22 long rifle, long and short cartridges. Will trade for anything pertaining to airplanes or aviation. What have you?—Vito Marchino, 15140 Earlington Ave., Harvey, Ill.

CAMERAS OR ENLARGERS wanted. Will exchange a complete set of The Book of Knowledge (20 vols.) like new and worth $60.—Carl Kanner, 824 Gravesend Ave., Brooklyn, N. Y.

FOLDING KODAK, No. 2, will exchange for plans of training glider or plans of lightplane.—Jas. Corbett, 64 Lansdown Rd., S., Galt, Ontario, Canada.

MOTION PICTURE MACHINE, like new, with film. Also a large Lionel electric train, large Meccano set, total value about $55. Will trade for a gear-shift car (roadster or coupe) or a 1930-31 twin motorcycle in good condition.—Melvin Pazen, 3301 N. Davidson St., Spokane, Wash.

EASTMAN RAINBOW HAWKEYE box camera in perfect condition, pictures 2½ x 4¼, regular price $2.50. Will trade it for a slightly used Model "A" Ford generator or other late car generator provided with a "Vee" type belt.—Arnold Holden, Bucyrus, N. Dak.

AERIAL CAMERA WANTED. Will trade American School of Aviation Course for an aerial camera.—W. A. Rigg, Withee, Wis.

TELESCOPE. Will trade copies of Science, Airplane Mags or Mechanical Mags for telescope.—Charles Caldwell, 171 8th St., Troy, N Y.

KEYSTONE MOVIE PROJECTOR—a wonderful machine. What have you to trade?—Richard Lewis, 49 Ardmore Ave., Providence, R. I.

CORRESPONDENCE COURSES

AVIATION COURSE, 37 lesson course of the A. I. of U. S. A., one National Geographic Magazine (1918). Want a motorcycle or anything connected with aviation.—Joe Michaels, New Hampton, Orange Co., N. Y.

GROUND SCHOOL COURSE in aviation and a number of aeronautic books. Want a light car or what have you?—Henry Orloff, 211 E. 159th St., Harvey, Ill.

CORRESPONDENCE COURSES in Taxidermy, Modern Foremanship, Industrial management, Showcard writing, Furcraft, Electrical Courses. Will swap for anything of value. Also have game chickens to trade.—Jack Farris, Conway Springs, Kan.

AVIATION COURSE, Dayton School of Aviation. Will trade for a pair of No. 8 military boots or what have you? Anything considered.—K. L. Walker, Valley Falls, Kan.

AVIATION COURSE valued at $35. Will swap for a 22 cal. high power rifle or motorcycle.—B. R. Weathers, Knapps, Tex.

LaSALLE LAW COURSE, 15 vols. Also a course in candy making. Will trade for a typewriter, guns or binoculars.—Jimmie W. Holdes, Rt. A, Lamesa, Tex.

ENGINES—MOTORS—PARTS

HENDERSON ENGINE, partly converted, a small 6-inch circular saw table and numerous other articles to trade for a stop-watch, firearms or what have you?—J. G. Whaples, 689 Stanley St., New Britain, Conn.

BOSCH MAGNETO in good condition. 4-cyl. type to trade for a 6-cyl magneto in good condition. My mag has plenty of fire and will start any engine.—Jock Moss, R. D. No. 3, Oxford, Miss.

ENGINE AND WING wanted for Heath Parasil. H. John Watson, 1225 Main St., Wellsburg, W. Va.

LAWRENCE ENGINE, 2-cyl., 20 h. p., with prop. Will trade for sailboat or stamp collection.—Murray Brosius, 713 Church St., Nashville, Tenn.

MAYTAG ENGINE, gasoline washing-machine type. Also a 1-tube radio and a new motion picture projector that I will trade for a motorcycle engine.—James H. Bodmer, Kenmare, N. Dak.

LIGHTPLANE ENGINES and parts wanted. What have you and what do you want? I have auto tires, new and used, also tubes. All sizes. Also Model "T" Ford parts, new rods, set of aluminum pistons, (used). Also have a complete home wood-working equipment, and an Indian Twin—less magneto. I also want a good sailplane or glider.—J. D. N. Kelley, 1112 S. Haskell Ave., Dallas, Tex.

STROMBERG CARBURETER for Model "T" Ford engine, new float needle and seat. Will swap for aircraft or radio books of a late edition. What have you?—Sherman H. Purnell, Blandinsville, Ill.

CURTISS OX-5 ENGINE, less prop and radiator. Also a .22 cal. rifle, 1928 Model repeater, and a number of magazines and other articles to trade. I want to swap these things for a plane in good condition, either licensed or eligible for license. What do you want to trade?—Albert Rousey, Route 4, Box 106, Belvidere, Ill.

ANZANI ENGINE WANTED, 80 h. p., a LeBlond 90 h. p. or a Kinner 100 h. p. engine. These engines must be equipped with magnetos, prop hub and carburetor. What have you in this range?—H. G. Warner, Fountaintown, Ind.

INBOARD MARINE ENGINE, single cylinder type in good condition. Will swap for a pair of primary glider wings in good condition with ailerons and controls.—Charles J. Farmer, R. F. D. 1, Eden, N. Y.

GNOME ENGINE, 100 h. p., American School of Correspondence School of Aviation Course, one pair of light aero-boat floats not quite completed. I want a Ford V8 or Ford "A" engine in good condition, suitable for marine use. What have you?—J. H. Hachmann, Bellevue, Ia.

HISPANO-SUIZA ENGINE, 180 h. p., Model E. In good condition but now dismantled for inspection. I want a used Continental A-40 or a 45 h. p. Szekely engine, used or damaged. Also wish a pair of Robert Bosch flange mounted 4-cylinder magnetos and a Stromberg carbureter for the Continental A-40 or the Szekely.—L. P. Stickel, 1758 Fauver Ave., Dayton, Ohio.

LIGHTPLANE ENGINE, 4-cyl., will trade for a motorcycle, later than 1926 model.—Romie Blidan, 6323 Richmond Road, S. Euclid, Ohio.

MODEL "A" FORD ENGINE, converted with prop. An Anzani 85 h. p. 3-cyl. air-cooled engine, one set (2) of 20x4 drop center aluminum disc wheels with Firestone non-skid tires and tubes, one set (2) of 26 x 4 wheels with clincher tires, wire, tubes. A tachometer, switches, cables, turnbuckles and other lightplane parts. I wish to trade these items for a 2-place licensed ship, Taylor Cub, or similar small plane. Will pay some difference if necessary. What have you got?—Ira D. Varney, Powell, Pa.

K5 KINNER ENGINE wanted with altimeter, tachometer, oil temperature and pressure gauges, dope, covering, balsa, wires, cable, tubing, 26 x 4 wheels and tires. Will trade automobile, tractor plow, aviation books and aviation correspondence course for the above supplies.—Edward D. Tracht, Route 2, Galion, Ohio.

ELECTRIC WASHING-MACHINE MOTOR, ¼ h. p. Will trade for a ¼ h. p. gasoline washing machine engine. Will also trade cardboard model of Junkers G38 worth about $2.25.—Willard Rowling, R. F. D. 1, Allegan, Mich.

2-CYLINDER ENGINE WANTED. Will exchange World War medal and Civil War medal, a short-wave crystal radio set, motorcycle goggles, 3-foot telescope, and 32 pictures of Kelly Field, Chanute Field and Selfridge Field.—Howard Dahms, 2407 E. Boston Ave., Philadelphia, Pa.

GLIDERS—SAILPLANES

PRIMARY GLIDER WANTED. Trade with some cash.—Gerald Breneman, Columbus Junction, Iowa.

MEAD PRIMARY GLIDER, cabane, plywood keel, control cables, flying and landing wires, tail surfaces and four new spars. Will trade for pair of 20 x 4 wheels, tires and tubes or what have you?—H. R. Doerflein, 3069 N. 10th St., Milwaukee, Wis.

NORTHRUP GLIDER, identified. Fuselage cracked in a few places but has been repaired. Will exchange it for a Model "A" Ford or a Harley motorcycle with a side-car. Will also consider parts for a Corben lightplane that we are about to build.—Ed C. Schmidt, 1922 Missouri Ave., Superior, Wis.

SAILPLANE with a span of 62'-0". Just relicensed by the D. C. This ship has won her share of victories in Southern California. I also have a good trailer with new tires and tubes. Am now working out a design for a high performance biplane and want a Warner 110 h. p. engine for it. Might also consider a Model "A" Ford or some ship.—Sterling E. Owen, 3945 4th St., San Diego, Calif.

GUNS—SPORTING GOODS

RIFLES, two 22 cal. rifles, a bugle or an accordion in trade for aeronautical books or magazines. One rifle is a Stevens single shot while the other is a Stevens repeater, both in good condition.—L. W. Fisk, 143 Sylvan Ave., West Hartford, Conn.

WINCHESTER REPEATING RIFLE, almost new. Uses 22 cal. short, long or long rifle cartridges (Model 06). In good condition. What have you to trade for this gun?—Ray Hoyesen, 230 Bond St., Bridgeport, Conn.

STEVENS RIFLE, bolt action, 22 cal. repeater rifle. One original Colt revolver made about 1850, still in serviceable condition. A $10 Spalding tennis racket. One U. S. Engineers compass in case. Many aviation, boating and mechanical magazines. Also a hunting knife carrying the name TRIER-1918-1919. Would like to swap for an Indian 45 or a Harley motorcycle. Must not be earlier than 1926. John G. Seifreid, Jr., 1850 Haring St., Brooklyn, N. Y.

STEVENS-BROWNING, brand new 20 gauge shotgun for a set of air-wheels, size 850 x 10, to fit an OX-5 Travel Air plane. Will also pay some cash.—A. Kuball, Jr., Dresden, N. Dak.

MISCELLANEOUS

SHORT WAVE RADIO receiving set wanted. Will trade models of Boeing P-12C, Curtiss Hawk P-6E and others. Will add some cash if necessary.—Joseph Colioto, 118 Second St., Albany, N. Y.

WELDING AND BURNING OUTFIT, Oxy-acetylene outfit complete, with two torches, one burning and one welding, set of gauges, hose and all wrenches. Have two extra torches. Will swap for a Continental A-40 Aeronca, or will swap one outfit for a Heath-Henderson with a deep case. This can be in any condition. Also have a Caille Outboard motor, Raja Racing head that I will also swap for a lightplane engine.—Charles Lackey, 1143 Cherry, Pottstown, Pa.

ALL-ELECTRIC RADIO, blueprints for lightplanes and flying models, a two-foot stack of POPULAR AVIATION and other aero magazines, small jeweler's vise, excellent for model work and many other useful articles. Want motorcycle in running condition or what have you?—Herbert Brown, Box 139, Route 1, Livermore, Calif.

ICE SKATES, size 9, Maytag engine with chain sprocket welded to the flywheel, needs timing. Two fifes, one indoor ball and bat, Mossbergeon single shot 22 cal. rifle. Uses shorts, longs and long rifle cartridges. Boy Mechanics, Vols. 1 and 2. Fiction of all sorts by many authors. An antique writing outfit, very old but in good condition. Two letters and envelopes of period before stamps were made. Several hundred stamps, some valued at $1.50 each. Battery case for Delta bicycle light. Excellent pictures of Lindbergh, Post and Gatty. Prefer twin motorcycle engine, lightplane engine or lightplane parts, but will trade for other things.—William Curtis, 23 Platt St., Albion, N. Y.

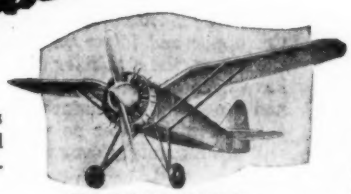
PIANO ACCORDION WANTED or other musical instruments. Have scale models to trade, and some other articles.—Gordon A. Nesbitt, 1722 Central Ave., Anderson, Ind.

FLORIDA REAL ESTATE. Have four lots in North Palm Beach, Fla. One large corner lot, 102 x 100 feet, one side facing on an 80 foot

(Concluded on page 329)

...and don't forget these Big 12-in. Flying Models for 25¢

Postpaid
(No Orders Accepted for Less Than 2 Kits.)

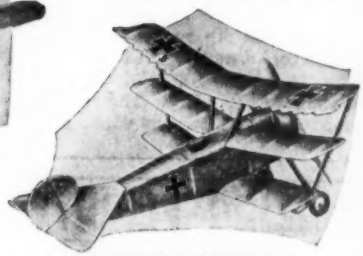


THE POLISH FIGHTER
12-in. Span

These are the "IDEAL-O-PLANE" Kits originated by IDEAL, which started everybody building this type of inexpensive small Flying Models.

When we originated this type Kit, we planned everything so carefully, and made these Kits the last word in completeness and accuracy. That is why they are unquestionably the finest Kits anyone can obtain today at this popular price.

Here are six of the most wanted Models of the day; every one with full-fuselage body, cambered wings with special ribs, shock-proof landing gear, carved balsa propellers, and other features of expensive Models. . . .



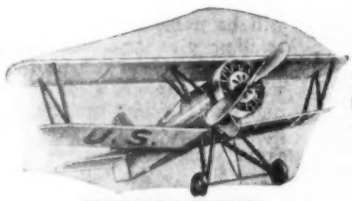
THE FOKKER TRIPLANE
12-in. Span

. . all Guaranteed to Fly!

Each Kit is complete, there is nothing more you need to finish a perfect Flying Model. Every part is accurate and true; you will find it much easier to make good-looking Flying Models with these "IDEAL-O-PLANE" Kits. Compare them with any others and see if they do not give you better all-round value for your money. Our big-scale production (we are selling thousands of these Kits) enables us to put out better value for this popular price. If we had to pay the packing and postage charges on single Kits we could not sel them at this price. Therefore, we cannot fill orders for less than two (2) Kits at one time. So look over these six Models and pick any two you like—then we will deliver fully prepaid to your door.

Do it now and get your Models Started!

THE SOPWITH CAMEL
12-in. Span

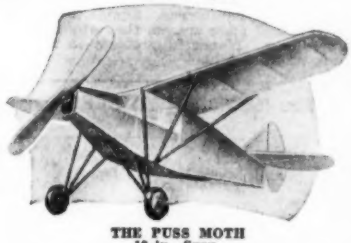


THE BOEING FIGHTER
12-in. Span

Send for Our New Bulletin

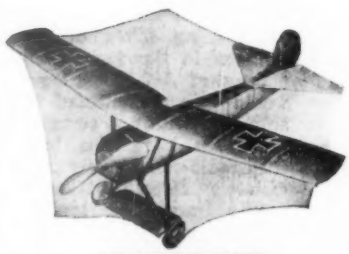
A dandy, big Tabloid Magazine full of new information on Airplane and Ship Models, Fittings and Supplies.

Send 3c Stamp for your copy now.



THE PUSS MOTH
12-in. Span

Ideal Airplane & Supply Co., Inc.
22-26 West 19th Street, New York



THE FOKKER D-VIII
12-in. Span

Canadian Model Aircraft,
47 Hawarden St.,
Montreal
(Canadian Prices are 40% Higher to Cover Customs Duty)

DEALERS: Write for Details and Discounts

IDEAL AEROPLANE & SUPPLY COMPANY, INC.,
22-26 West 19th Street, New York.

Enclosed find $.....(No Stamps, please; Cash in Registered Letter, Money Order or Check) for which please send me the items checked below:

"IDEAL-O-PLANE" 12 in. Flying Model Kits

.....Boeing Fighter Kit .....Fokker D-VIII Kit .....Fokker TriPlane Kit
.....Polish Fighter Kit .....Sopwith Camel Kit .....Puss Moth Kit

(Kits are 2 for 50c; 3 for 75c; 4 for $1.00; all 6 for $1.50. We pay all packing and postage charges. No orders accepted for less than two (2) Kits. Check the Kits you want in the list above and mail this coupon at once.)

.....Enclosed find 3c stamp for New IDEAL Bulletin

Name.....

Address.....

Vought Corsair

(*Continued from page* 316)

is 3/32 inch square. The trailing edge is 1/16 x 1/8 inch. The ribs are all cut from thin balsa approximately 1/32 or a trifle less in thickness. The nose ribs are the small sections of a rib placed between each full length rib.

These small nose ribs help to maintain the full camber of the wing preventing the tissue from sagging. Each side of the wing has a dihedral of ½ inch beginning at the second rib from the center to each side of the wing. The tips are made of bamboo and when trimmed to the proper size are approximately 1/32 x 1/16 of an inch in cross-section.

WING—LOWER

The lower wing is built in two pieces having spars which are placed on the top side of the rib so that they meet and connect directly with the wing struts. This makes a solid connection when cemented in place. The spars for the top wing are on the underside to give added strength to the strut joint.

Before fitting the struts, the wings must be covered and the struts should be a trifle longer than necessary so that the correct fit can be made at the final assembly. The spars and the leading and trailing edges of the lower wing halves extend beyond the first rib approximately ½ inch. This small extension rests on the lower longeron and securely holds the wing panels in place. The leading edge should be inclined approximately 3/32 inch, which will give the correct angle of incidence.

COVERING

The wing and tail surfaces are covered with yellow tissue. As a silver paper isn't available, the body is covered with red tissue. No tail stripes are used on Navy planes at present, and the only identification are the stars on the upper and lower wings. After all the wings, the stabilizer and the rudder have been covered, they should be pinned to a flat surface and lightly sprayed with water so that the tissue will shrink snugly over the framework.

The body is covered with numerous strips running fore and aft. After the body has been completely covered the stabilizer and rudder are attached and the windshield put in place. The top wing is first cemented to the fuselage by the small inverted center section "V" struts.

The rear center section struts are then added so that the top wing has an angle of incidence approximately 3/32 inch. The lower wing is fitted in position so that the leading edge is one inch farther back in a perpendicular line with the top wing leading edge. As the dihedral has been built into the top wing, the struts should be fitted so that an equal amount of dihedral will also be in the lower wings.

PROPELLER AND TOWNEND RING

The propeller for the flying model should be approximately 7½ inch in diameter. The pitch should be medium. Four strands of 1/32 x 1/8 inch flat rubber are required for the flying model. Five strands may be employed if the model is a trifle heavy. To help streamline the motor, a Townend ring is built from two layers of 1/16 inch balsa with the grain running crosswise, or in direction of the fuselage length. One layer of typewriting paper should be cemented between the layers of balsa.

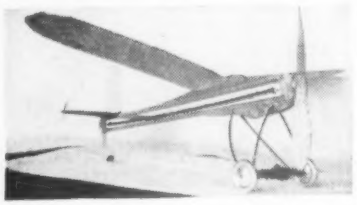
The ring should be left resting around the form upon which it was built until thoroughly dry.

END.

AMAZING FLIGHTS

SPEED - STABILITY - DISTANCE

The "DING BAT" SENIOR



OUR "Ding-Bat Senior" is a high-duty 22-inch outdoor model that flies far and fast. It employs the new HELICOIDAL WING, a radical improvement in model design. It is a flyer—not a floater—that duplicates full size performance. Simple to build. Will withstand more crashes than any model you ever saw. Wonderfully steady in flight because of its weight.

Complete Kit, postpaid.....83c

The "ACME AIR CHIEF"

THE "Acme Air-Chief" is a 22-inch built-up fuselage type model designed solely for the purpose of flying—not as an ornament. It is a fast flyer, with good duration, yet is heavy enough to show surprising steadiness in outdoor flights. You will get a lot of fun out of this really fine model.

Complete Kit, postpaid.....$1.00

Free Offer! Up to June 1, 1933, we will include the material for a 10-inch DINGBAT SKEETER with either of the above kits, free of charge. Order now to insure getting two models for the price of one.

Yes, we have no catalogue!

ACME MODEL SERVICE

6227 Byron Street Chicago, Ill.

● GLIDER ENTHUSIASTS ●

Bank indicator, spirit type **$1.89**; **Inclinometer**, spirit type **$9.95**; **Altimeter**, "Zenith" 20,000 ft. **$5.45**; **Compass**, Jones Bracket type **$5.95**; **Air Speed** indicator, strut type, **$7.45**.

75c Glider Pilot's Log Books—Now 22c. Paper cover 15c Wing Emblem for the coat lapel **39c. Colored Helmets**, Jean cloth, lined with same material.

Avoid C.O.D.Charges—Send Cash or M. O.

SMOOKLER—Dept. P-1, 489 Fifth Ave., New York, N. Y.

Radio

(*Continued from page* 286)

may be used on various makes of aircraft engines, thereby allowing the plane owner to use this same material on another type ship. This is a convenience, in that most of the private owners keep graduating to larger equipment as their flying progresses.

On the instrument board, a metallized strip should connect all the instruments, tubes and wire shielding, and be grounded at both ends to the metal longeren on each side of the fuselage. This of course should be located unseen in the rear of the board.

In checking over the efficiency of the shielding, the radio is adjusted to maximum sensitivity. If the shielding is correct no noise should be heard in the headphones. The best results will be obtained by checking this with the airplane in actual flight, at cruising speed. Frequent inspection of the shielding should be made to ensure vibration or other causes do not make broken ground connections. A certain amount of noise in the receiving set may originate from commutator ripples in the generator, electric tachometers or other electrical instruments, but this may be so slight as to be unnoticeable, and should not interfere with the reception.

In the power plant of the airplane radio, the wind driven generator, for one reason, due to its interference with maneuverability, has given way to the more modern dynamotor units operated off the plane's 12-volt battery supplying the plate potential for the radio receiver. The filament supply is obtained from the same 12-volt battery. It is current practice to use the same battery for the plane's lighting system.

There are three types of antennas in general use today. These are the mast type of antenna which is a short rod or pole about six feet long and mounted in the rear part of the fuselage. The mast may be either of wood or metal tubing, if the latter is used it will be necessary to insulate it. The trailing wire type, which consists of a wire with a lead fish on the end of it, which is run out through the bottom and trails behind and below the ship; and the fixed wire type, which runs from wing tip to wing tip or from wing tips to the tail.

Not satisfied with the many uses offered to aviation by radio today, engineers have gone a step further and experiments have begun on a system of warning pilots of an impending collision in the fog. Utilizing a frequency of 100,000 kilocycles, signals would be communicated when another ship was within a certain radius. Experiments have also been conducted with radio-echo altimeter that measures distance directly from the ground rather than at sea level. The future will not see the airplane without its hearing and voice.

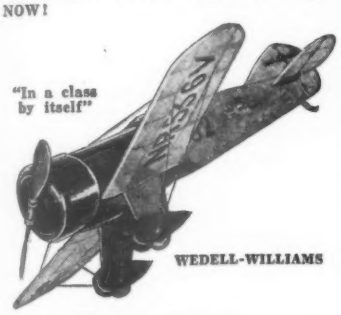
END.

SELLEY QUALITY+LOWEST PRICES= MOST Startling FLYING KIT VALUES!

Here truly, is the BIGGEST VALUE ever offered in authentic flying scale models! These beautifully designed, long distance flyers introduce the latest and most advanced methods of simplified construction created and produced exclusively by SELLEY.

Every model is packed in a separate box, labeled and sealed and comes complete with full size 3-view plan, layout sheet with all details clearly shown, SPECIAL MACHINE TURNED BALSA COWLS, PROP, HUB, WHEELS. Printed balsa rib and bulkhead sheet, colored tissue, cement, music wire, rubber, reed, bamboo, printed motor dashboard, insignia sheet and best grade balsa sized sticks. What a value! Select yours NOW!

"In a class by itself"



WEDELL-WILLIAMS

"Amazing performance"

GEE-BEE SPORTSTER

95c EACH *Postage 15c West of Miss 25c*

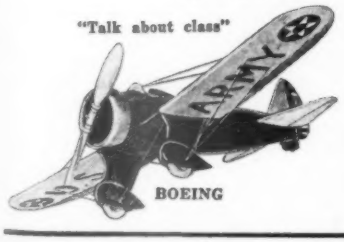
Plans Alone **25c** Each.

ALL 18" WING SPAN

"A Sure Contest Winner"

A-8 Attack

"Talk about class"



BOEING

READ THIS FOR YOUR PROTECTION

Every SELLEY product is guaranteed to be the best obtainable and is manufactured in the largest and most modern factory in the world. You may safely choose any construction set or accessory and if it does not meet with your entire satisfaction your money will be immediately refunded!

Selley Alone Can Make This Broad Guarantee!

Each kit is packed complete in a strong, attractively colored and labeled box with printed balsa sheet, balsa sticks, special turned wheels, rubber cement, two colors Jap tissue, music wire, bamboo and reed with complete easy-to-follow building instructions and large, full-size 12 x 18 plan.

BUHL BULL PUP

ALL 14" WING SPAN

CURTISS NAVY RACER

25c ea

POSTAGE

10c for every two kits
20c for four kits
30c for six kits

FAIRCHILD

AERONCA

HEATH PARASOL

Talk about flying! These 14" flying models assure amazing performance. Experiment in our factory has proven that these planes fly with extraordinary ease and speed. Try them and convince yourself!

VERVILLE AIR COACH

This offer is so remarkable that many will not believe until they actually build and fly these new, sensationally priced SELLEY construction sets. Beware of inferior kits! Words alone never assure quality! These kits are accurately designed, realistic flying scale models embracing the same quality that thousands of boys enjoyed in SELLEY'S much higher priced kits. Remember this! NOTHING IS CHANGED BUT THE PRICE AND THE PRICE IS THE LOWEST IN OUR HISTORY! Large scale production makes these extraordinary bargains possible without sacrificing SELLEY'S enviable reputation for superior model products. It pays to buy from the leader! Now choose the finest flying kits and save! Pick your favorites and send in your order today!

DEALERS and SALES REPRESENTATIVES

Please write for special discounts on the new popular priced SELLEY line.

Captain Mollison's **PUSS MOTH** *The Heart's Content*

Postage 20c

75c EACH

Plans Sold Separately 25c

This faithfully reproduced FLYING SCALE Model with its 18" wingspan, bright green fuselage and yellow wings is a "beauty." The Selley Kit comes complete with all parts printed on balsa wood, special fittings, rubber cement, colored paper and full size plan, with detailed building instructions. Send for it NOW!

Send for Airplane Catalog.
Send 5c for Boat Catalog.

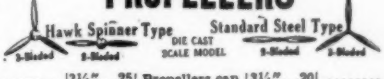
Selley's Model Supplies At Deep-Cut Prices

SPUN ALUMINUM COWLS

Diameter	Anti-Drag	Open Cowl	Closed Cowl
1 1/8"	.20	.20	.20
2"	.26	.25	.25
2 1/8"	.28	.30	.30
3"	.30	.35	.35
3 1/8"	.40	.45	.45
4"	.60	.55	.55

Cowls made in 4½, 5, 5½, 6, 7, 8, 9, and 10" diameters. Packing and Postage, 6c each.

PROPELLERS



3½".	.25	Propellers can	3½".	.20	
4".	.35	4".	.30	be had in the	4".	.25	4½".	.30
4½".	.45	4½".	.35	following sizes	5".	.30	5".	.45
5".	.50	5".	.35		5½".	.35	6".	.60
5½".	.60	5½".	.40	7, 8, 9, 10,	6½".	.45	Alumin	
Alumin		6½".	.40	11, 12, 15, 18	Alumin			
6¼".	.70	Alumin						
7".	.80	7".	.55	21, 24".	6¾".	.50	7".	.70

Postage 3c a prop. Send for 5c catalog.

SELLEY MANUFACTURING COMPANY
1373-P GATES AVE. BROOKLYN, N.Y.

Airy Chat

(*Continued from page 276*)

ment, coming from the fellow that it does, but we've heard this song so long that we are not all excited. On the contrary—Ho-Hum.

* * *

SOME time ago I made the statement that my photo collection may not be the biggest, but I believed that it was the oldest. When Maurice Commanday, 18 Ridge Road, Yonkers, N. Y., told me of the 30,000 photo collection of Grahame Duce, Baltimore, Md., then I was darned sure mine was not the largest. Now my hopes to fame are entirely blasted, for one of the Early Birds came into the office the other day and told me of an aircraft picture collection that was started back in 1848 and which has been supported and sustained by three generations of the family. La, La, this knocked out all of my pretensions.

My gallery actually assays 7,120 pictures in all, 2,230 of which are actual photos, 894 blueprints and the rest are pictures of assorted classes. However, this collection is carefully assorted with no duplicates nor irrelative pictures such as appear in some collections.

* * *

TURNING over the pile of letters, I have before me a pleasant letter from Ing Humberto Ramirez Villarreal, Gelati 60 Tacubaya, D. F., Mexico, who makes very sage comments upon one of the lamented features of model and sportplane building. I thoroughly agree with him in his remarks and am therefore reproducing this letter for your consideration.

In relation to your Model Contest, which was a complete success in all but the Original Design Section, No. 4, kindly let me tell you that, in my opinion, this partial failure was due to the fact that model builders are very seldom inclined toward designing. And, on the other hand, persons who have the ability to draw find it more practical to project their ideas on paper than in the form of models.

The drawing ability is more frequently accompanied by some degree of creative genius than manual skill. Moreover, an error in a handicraft is not so easily corrected as on a drawing.

I think, that in the aviation field, there are a great number of designers, including amateur designers, large enough to crowd a contest for sportplane designs. Why not start one now?

Some contests of this kind have been organized before, but there would have been more competitors if the promoters had taken out the ghost of technicalities which they regarded as a first place requirement.

The majority of highly trained minds lack creative genius, because their thinking is channeled by scientific routine and a controlling respect for precedent. At the other extreme there are the reckless minds of those who do not pay attention to any rule. Most of the successful inventors and designers come from an intermediate section lying between the scientists and those of fanciful minds.

Make your contest for that middle section. Ask for good practical sense but do not urge deep calculations nor stress analysis. Yet do not exclude them. Be tolerant. Give a chance to everybody but prize genius above all—even above cold science.

In order to judge the merits of the entries in the proposed design contest for sportplanes, the following method of indicating the qualities or rating is suggested.

GENIUS (Novelty of design)	*5 Pts.*
PRESENTATION (Neatness and completeness)	*2 Pts.*
ECONOMY OF CONSTRUCTION	*1 Pt.*
Technical Study	*1 Pt.*
Elegance	*1 Pt.*
Total	*10 Pts.*

If you accept this suggestion, please do not ask for hallucinations—have a contest for practical designs for the present day with a view of selecting a type for commercial production, as well as for home-building.

Well, this sort of a design contest sounds quite interesting, and is well worthy of consideration. We have started this idea, in a very elementary way, in our Dream Ship Section, but the most interesting and useful sort of contest would be an actual design of a workable sportplane, drawn in full and carefully worked out in detail. Yes, we'll think this over, and in the meantime, would be glad to have comments from our readers on the subject.

* * *

FROM time to time, we have had a lot of very interesting and popular departments in this mag, but none of them have shown the tremendous kick and vigor of the Barter and Exchange Department which is now a ruling favorite. Just take a look and see how it has grown.

* * *

Will meet you here in June.

J. B. R.

KITS 15" Flying Scale Models

S. E. 5; Travelair Mystery Ship; Stinson monoplane; Lockheed Vega; Lockheed Orion; Gee Bee; Laird Supersolution; Curtiss Hawk P-6E; Curtiss HELL-Diver; Bellanca Skyrocket; Fokker Amphibian; Nieuport Scout; Boeing P-12B; D. H. Tiger Moth; Pfalz Pursuit; P. Z. L. VI; Supermarine 6B Gloster IV seaplane.....KITS 65c postpaid

Plans separate, 10c each, 3 for 25c

KITS 22" FLYING SCALE MODELS

Gee Bee; High Wing Pursuit Model B1; Fairchild "24" $1.00 postpaid

Plans separate, 10c each

CELLULOID WHEELS—MUSIC WIRE straightened
¾" per pair.....04c 36" lengths .014, .016,
1" per pair.....06c .020, .026, .032, .036,
1⅜" per pair.....08c 18 feet.....05c

ALUMINUM WHEELS 1" dia. Light as Celluloid Wheels, per pair.....08c

1-32x2x18 Balsa	8 for 10c	Grade A Tissue, Red, White
1-16x2x18 Balsa	7 for 10c	Blue, Green, Brown, Orange
⅛x2x18 Balsa	6 for 10c	Yellow, Black, 2 sheets, 10c
2 x4x18 Balsa	25c	1-32 sq. rubber, 75 ft. for 10c
2 x6x18 Balsa	40c	3-64 sq. rubber, 50 ft. for 10c
⅜x⅜x5 Balsa	8 for 5c	3-32 flat rub., 40 ft. for 10c
⅜x⅜x6 Balsa	7 for 5c	1-8 flat rubber, 35 ft. for 10c

ALUMINUM COWLINGS

	open or closed face	Drag rings
1½" diameter	15c	15c
2" diameter	18c	18c
3" diameter	25c	25c

Add 15c for postage. Discount to Dealers and Clubs. Send 3c stamp for Price List.

DALLAIRE MODEL AIRCRAFT CO.

10140 Crocuslawn Avenue, Detroit, Michigan

Read quotation from letter to the right . . . one of many proving that Lincoln trained men have won big success in aviation. You can be one of these big salaried pilots or mechanics. The famous training of this World's Best Known School will prepare YOU for the big pay jobs. Government Approved School, internationally known. Unexcelled equipment, including blind flying by instrument, and training that wins quick advancement.

Our Government Licensed Instructors know how to train you for the better aviation jobs that pay the big money. Come to Lincoln and be sure of success.

Now is the time to get ready for the big pay jobs aviation will offer properly trained pilots and mechanics. Exceptional opportunities in Central and South America as well as in the U. S. Aviation courses taught in either English or Spanish. Write for complete information. State your age.

Lincoln Airplane & Flying School
233C Aircraft Bldg. Lincoln, Nebr.

$400 a Month!

"... Since I completed my training at the Lincoln School I have been employed continuously as pilot. My salary ... is $400 a month ... Lincoln trained pilots are preferred because of the character of the training they receive."—C. L. Currier.

U. S. AIR CORPS

Takes in 600 men this year for FREE FLYING TRAINING. Gives them over 200 SOLO HOURS. Special Uniforms, Transportation to the Field, LIVING EXPENSES, and $75 a month while Learning. Real Flying Here. It costs absolutely nothing. Let Us Tell You How to Get In. Information about Uniforms, Rank, Leave, and Actual Life at the New $10,000,000 Field. Hand postman $1 and postage for entire information. Complete. Nothing else to buy.

FLYING INTELLIGENCE BUREAU
401 Judson Y. Rives Bldg. Los Angeles, Calif.

Q. & A.

(*Continued from page 292*)

QUESTION:—I. K., W. New York, N. J. (1) *Explain Warren bracing as used in building ribs. Where else is it used?* (2) *Why are the valve clearances of a Curtiss OX-5 different on Cylinder No. 1.* (3) *Why do two parachutes seem to repel each other when carrying a man between them at the same time?*

Answer:—(1) WARREN bracing is "zig-zag" bracing with all of the web members inclined. It was formerly used to a limited extent as interplane bracing for biplanes. (2) This is different because cylinder No. 1 is hotter than the others. (3) They don't do this of their own account. It is accomplished by pulling down or "slipping" the edge of one chute. This probably increases the speed of descent.

* * *

QUESTION:—O. S., Clearfield, Pa. *There were a number of questions and answers omitted in the "Official Exam Questions for Mechanics." Will you please answer them for me?*

Answer:—ANSWERS to these questions were purposely omitted for the reason that the answers would be too long and complicated to run in a single issue. For example, the reply to the questions on grinding valves would have taken several pages alone to make them complete. I suggest that you get a good book on aviation engines and look up the answers. It would be impossible to give so much space to this matter in P. A.

* * *

QUESTION:—H. K. L., St. Paul, Minn. *Why does aspect ratio affect the efficiency of an airplane wing?*

Answer:—THE actual reason is quite complex, but an approximate reply will say that this is due to the effect of end leakage on the wing. The pressure is greatly reduced near the tips for a distance of about one chord length, hence this low pressure area forms a greater percentage of a short stubby wing than of a long slender wing with a narrow chord.

END.

U. S. NAVY'S PILOT GOGGLES

THE COMMANDER

As Made for U. S. Navy—Contract 6314

"The Commander No. 1" Goggle meets U. S. Navy Dept. Specifications 329A for Aviators Pilot Type Goggles.

Precise Meniscus, optically controlled to rigid limits—Hardened. Style No. 1 price reg. $25.00. Now $20.00.

Meniscus-to safe optical standards. Style No. 2. Reg. $20.00. Now $17.50.

PRICES

Commander I—Clear lenses, guaranteed within U. S. Navy Standard, each .....Reg. $25.00

Commander II—Clear lenses, beyond Navy limits but within good optical limits each.... Reg. $20.00

Plano curved lenses optically perfect. Sponge rubber mask. Metal frames. Unrestricted vision. Ventilated by positive action of air currents. Aluminum case. Selected by Commander Byrd's Expedition.

NO BETTER POSSIBLE

Avoid C.O.D. Charges—Send Cash or M. O.

SMOOKLER, Dept. P-2, 489 5th Ave., N. Y. C.

Junior Ace

(*Continued from page 308*)

Shellac or Varnish, as this protects the ribs from dampness.

A small pair of tweezers will be of great help in holding the small nails when you nail on the gussets. Use a hack saw for cutting the ¼" cap strips and braces as a larger saw will tear the grain of the wood.

Now that you have all the dope on the ribs, and have them all completed according to the blue-print, lay them aside and study the wing assembly in which the ribs play a leading part. An airplane wing is not really complicated, it only looks that way because of the duplication of similar parts. There are only four general groups of members: the ribs, the spars, the edging and the interior bracing.

THE WING ASSEMBLY

The ribs form the direct support for the fabric used for covering the ribs. The compression ribs are special ribs used for reinforcing the structure at points where the diagonal bracing throws stress into the ribs. It should be noted that the ribs support the fabric against the air pressure and at the same time give the proper curvature to the fabric so that the required airfoil or wing section is obtained.

For the support of the ribs, the "spars" or wing-beams are run the whole length of the wing, the ribs being firmly attached to the spars. The spars are subjected to bending by the direct action of the air pressure on the ribs, and are given an additional compression stress by the wing bracing when the ship is in flight. As it is obvious that all of the load and full weight of the ship, plus the compressive stress, is carried by the spars, it is certain that they should be as strong and well built as it is possible to build them.

The front edge or "leading edge" of the wing maintains the shape of the wing at the nose against the wind stream, while the trailing edge at the rear simply holds the fabric in place and taut over the surface.

Interior braces, or diagonals, are necessary for taking up the drag stresses by forming a truss with the wing beams or spars so that the wing is not bent back by the wind-stream. The compression ribs take up the thrust from the tie-rods so that these ribs actually form a part of the wing trussing system in addition to their ordinary purpose. Therefore, do not slight the compression ribs nor try a short-cut by making all ribs of the common rib type. If reinforced compression ribs are not used, collapse of the wing is almost certain.

Study over the accompanying photograph and the wing assembly carefully until you are thoroughly familiar with each of the parts used.

END.

PATENT YOUR IDEAS REGISTER YOUR TRADE-MARK BY

Z. H. POLACHEK 1234 BROADWAY 31ST. NEW YORK

REG. PATENT ATTORNEY PROF. ENGINEER

CALL or SEND your SKETCH or SIMPLE MODEL for CONFIDENTIAL ADVICE No Charge for Consultation

DO IT NOW

— — — — COUPON — — — —

Dear Sir:—Please send me full information and literature about Patent Protection, without obligation.

Name.....

Address.....

The AERO-JIG SAW PUZZLE you've been waiting for!

150 PIECES that show BRITISH HAWKER FURIES diving to death at 300 M. P. H.

THE PICTURE MEASURES 8 x 12

TEST your ariplane knowledge by piecing together this exciting AERO PUZZLE.

WE PAID $200 to the celebrated Roland Langley for the original painting.

When it is completed paste it up and hang it in your DEN.

SEND for this colorful, flying panorama, NOW!

Money order or stamps accepted.

MODEL AIRPLANE DEALERS —Send for special proposition.

PICTURE FANS—Send only 20c for this colorful picture in the uncut form.

25¢

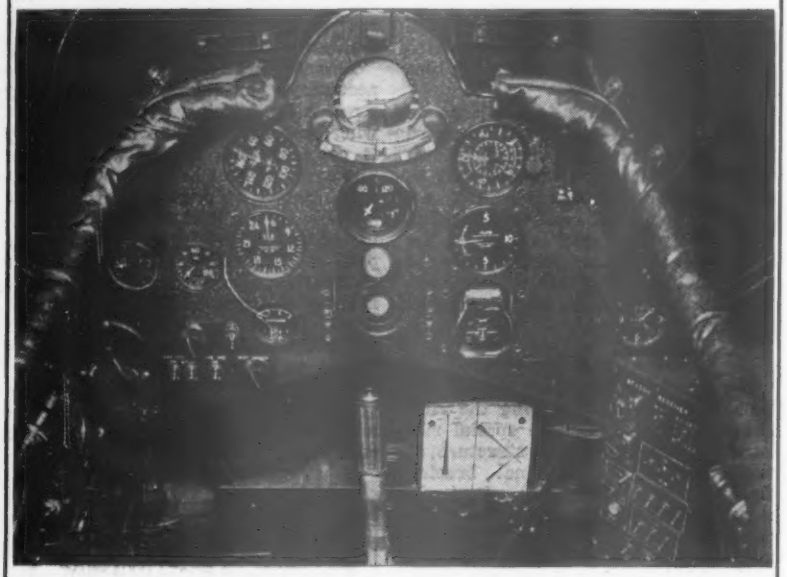
The Aero Puzzle Co.

Originators of the aero puzzle...

83 LIVONIA Ave. BROOKLYN, N.Y.C.

We Pay Postage

HOW AIRPLANES
Are Now Landed in Fogs



Interior view of the cockpit showing the new safety landing equipment in place. Landings are now possible with safety at zero visibility.

Another Advance in Flight Safety

MARVELOUS electrical devices, recently applied to aviation have dispelled the old dangers and uncertainty of air travel. And this new landing beam completes the cycle of radio beacons.

Read about this new marvel which is only one of the great big features in the June issue of POPULAR AVIATION. You will find much to interest you whether you are a pilot, student or arm-chair aviator.

POPULAR AVIATION
LEADS IN ITS FIELD

IN addition to the numerous features are the good old standbyes—the Departments—that have been so warmly endorsed by our readers. We have the new blue-prints for building the Corben Junior Ace, the useful Barter and Exchange Department, new dope on the Lightplane Association, the full page scale model drawings, the Question and Answer Department, the Dream ships and all the rest of them. YOU cannot afford to miss this issue nor any other issue.

Make sure that you get the June issue and the succeeding 11 issues by subscribing for P. A. This is the only certain way to get all of the issues. Do it now—the coupon is for your convenience.

POPULAR AVIATION,
608 S. Dearborn St.,
Chicago, Ill.

Please enter my subscription to POPULAR AVIATION for one year. Send me a bill later for $2.50.

Name.....

Address.....

City.....State.....

Just fill out this coupon and mail it to us now. We will bill you later—$2.50 for a year's subscription. It is not necessary to pay now.

Test Hopping

(*Continued from page* 310)

but to taxi a lightplane without brakes, when in a good wind, requires skill and patience, much more skill than an amateur possesses.

A point to bring up here is that the size of the rudder depends almost entirely upon the size of ship and fuselage length. Therefore, if you have too great difficulty in taxying your plane, maybe your rudder is too small.

Taxying into the wind is easy, but downwind you may find yourself suddenly doing the slickest little ground loop you can imagine. Remember, you can sometimes use your ailerons to advantage. An aileron "down" presents more drag to the wind than one raised. Therefore, if the wind is from your tail and you wish to turn to the right, drop the aileron on your left. Or if you feel your plane starting to turn to the left, against your will, drop your left aileron and apply both rudder and engine as needed. Of course, if you are taxying faster than the wind is blowing, the effect is opposite in the way you will tend to be turned by the ailerons.

A word of precaution when taxying down wind. Best hold your stick in the neutral position as shown in Figure 2, diagram (A). Here, the wind from the rear holds the tail down and yet if the engine is applied, the lift from the effect of the slipstream is not great enough to raise the tail. If the stick is held back, so the elevator is as shown in diagram (B) of Figure 2, wind from the tail can get under and may lift the tail up, nosing the plane over. This surprising occurrence has actually happened to planes. If the stick is held way forward a sudden burst of engine may lift the tail up high enough so that the wind can get under it and throw it on over.

Now assume you are in position for the take-off, headed directly into the wind at the far end of the field. First, make sure no other airplanes will be in your way. You give the plane the gun. Slowly but surely you raise the tail up to level position by moving the stick forward. The plane rushes forward, gathering speed, and soon you are off. Now don't go up more than a few feet.

Is the plane nose-heavy or tail-heavy and how much? Does it fall off to one side or another? By this time you may have to land, which you do by throttling the engine down and effecting as near a normal stall landing as the balance of the airplane permits.

If, in this flight, it is found that the plane is seriously nose or tail heavy, adjust the horizontal stabilizer in the direction for proper balance before going up again. No use taking up a plane so tail-heavy that it might stall with you and spin in. No use having it so nose-heavy you can't get the tail down for a proper landing.

END.

XUM

Barter and Exchange

(*Continued from page* 322)

paved street. Priced at $15,000. What have you to trade?—E. L. Bates, 1306 Sigsbee St., Grand Rapids, Mich.

ACROBATICIAN wishes to go barnstorming with some responsible party, exchanging services as well as acting as helper for flying instructions and expenses.—Sterling Hostetler, Topeka, Ind.

KOHLER CLARINET, E Flat Alto, with case. Will trade for a lightplane or glider.—J. Silveira, 710 Fourth St., Modesto, Calif.

MODELS—MODEL SUPPLIES

OUTLINE DRAWINGS of Curtiss A-8 Attack plane and latest Boeing transport. Will trade model airplane supplies for these drawings.—D. A. Deutsch, 816 Ave. "W," Brooklyn, N. Y.

COMPRESSED AIR MOTOR, 6-cyls., fine motor for models. Also 50 watt radio transmitter worth $50, complete with power pack, Northrup man-carrying blueprints. Will trade for anything aeronautical. Send photos of what you have.—Theodore G. Bellak, 496 S. 16th St., Newark, N. J.

SCALE PLANS, ¾ inch, of Curtiss Hawk P-3A, Sopwith Camel, Spad, Bishop's Nieuport, Boeing P-12C, Polish Fighter, Great Lakes Trainer, etc. Also have scale model of the Heath Parasol, span 23⅜ inches. Wish to trade for other Cleveland plans.—Val Werges, 4806 Milentz Ave., St. Louis, Mo.

MODEL PLANS. More than 50 full size model plans, drawings and instructions, new Northland skiis and expensive books of fiction. I want a large size guaranteed twin-pusher or any other flying models. What have you?—Robert Klink, 116 N. 14th St., Olean, N. Y.

MODEL MOTOR wanted for model airplane. Nothing over 5½ x 2½ x 3. Will trade Johnson and Johnson Aerokit, large size with case. New and not used. Raymond Hoyesen, 350 Bond St., Bridgeport, Conn.

MODEL GLIDER PLANS wanted for a model glider having from 24 to 36 inch wing span. Have a lot of plans to trade.—Ralph Ulmer, 2532 Glenwood Ave., Toledo, Ohio.

MOTORCYCLES—BICYCLES

REDBUGS or buckboards with Shaw engines wanted. Also Briggs and Stratton or Smith motorwheels wanted. I want chassis and motorwheels separate. Must be in good condition. Will trade old magazines for them and will also put up some cash.—Alan W. Brown, Greenhill Road, Madison, N. J.

MOTORWHEEL WANTED. What do you want? Bob Gagnon, Route 1, Box 76, Buena Park, Calif.

BICYCLE. A Trail Blazer bicycle in very good condition to trade for a good sun lamp of the filament type—not a carbon arc. Warren Valentine, Box 212, Myrtle Creek, Ore.

BICYCLE, one year issue of POPULAR AVIATION and Aero Digest, 2-tube battery radio, aeronautical books and Flying Manuals exchanged for a complete homestudy course or a small gasoline washing machine engine in running condition.—Royce L. Gibbs, Elmira St., R-6, Burlington, N. C.

MOTORCYCLE, 1931 Indian 4, 13,000 miles on it. Very good paint job with engine, battery and tires in A1 condition. Will swap for a Monocoupe in good condition.—C. Carlberg, care Postal Telegraph, Rockford, Ill.

MOTORCYCLE WANTED. Will trade a pair of cowboy "chaps" for small man, valued at $20, also a course in aviation valued at $35, for a good used motorcycle or a 22 cal. high-power rifle. Rifle must be as good as new.—R. B. Weathers, Knapps, Texas.

MOTORCYCLE in running condition. What have you?—Herbert Brown, Box 139, Route 1, Livermore, Calif.

MOTORCYCLE. I have an Indian Scout motorcycle, 1930 model, equipped with spotlights, saddle bags. Just overhauled and in A1 condition. Will trade it for a lightplane, such as a Heath Parasol. What have you?—Peter Kinney, 5 North Street, Franklin, N. J.

PHOTOGRAPHS—PICTURES

PHOTOGRAPHS, will exchange small photos for picture of an actual World War dog-fight. My photos are of modern ships, but if necessary will add cash to the trade for the fight picture.—Abraham Abrahamson, 5836 Catherine St., Philadelphia, Pa.

RARE GERMAN WAR PHOTOS to exchange with private collectors, here and abroad. Am interested in Allied wartime material, also modern military and commercial photos. I have the Sanke and Fokker sets available for exchange. What have you in the way of wartime aviation photos?—Joe Nieto, 2021 S. Hackberry St., San Antonio, Tex.

PHOTOS of modern commercial, military and racing planes to trade with anyone in the U. S. or foreign countries. I am interested in getting more racing plane and wartime photos.—LeRoy L. Milliren, 451 Earl Court, Elyria, Ohio.

NEGATIVES WANTED, size 116, of the following planes: Curtiss A-8 Attack, Curtiss Hawk P-6E, Boeing P-12C, Boeing XP-936, Boeing Bomber, Douglas Gull-wing, Berliner-Joyce P-16, Akron Fighter F9C-2. I will trade large pieces of fabric from several airplane crashes and will make up any balance in cash. Please name engine in each plane when you write.—Andy Beauseau, Van Vleck, Tex.

HEY FELLOWS! I would like to get in touch with Mr. Rush, supposedly in Chicago. Would also like to hear from photo collectors living near the Boeing plant and Valley Stream.—Eugene R. Johnston, 1420 Otter St., Franklin, Pa.

MODERN AIRCRAFT PICTURES to swap for a model of a German Gotha bomber.—Robert E. Howe, Savanna, Ill.

BUILDING UP COLLECTION, all kinds of photos to trade. What have you?—Jack R. Doyle, 21 Linwold Drive, West Hartford, Conn.

PHOTOS TO TRADE. I have many photos of American and foreign commercial and military planes to trade. Desire photos of the old Boeing, Douglass and Martin planes or pictures of ships in flight or formation.—G. S. Williams, 5740 36th Ave., N. E., Seattle, Wash.

AIRPLANE PICTURES wanted. Any kind.—Carl E. Shellman, 25 Bartlett St., Springfield, Mass.

AVIATION PICTURES of all kinds wanted for my collection. I have a few pictures to exchange, records of the aces serving with the various armies and list of Americans who were killed. Also the personal records of some of the greatest aces.—George W. Ladoux, 455 Hudson St., New York City, N. Y.

CAMERA PHOTOS WANTED, large size, of airplanes appearing in POPULAR AVIATION up to July 19, 1932. Also wish a telescope. Will trade issues of Science, Airplane Mags or Mechanical Mags.—Charles Caldwell, 171 8th St., Troy, N. Y.

PICTURES AND CLIPPINGS to trade for solid scale model kits or airplane magazines of any kind.—Thomas Richardson, 6 May Terrace, Maplewood, N. J.

PHOTOS. Have actual glossy photos, 4 x 5, of modern and war-time planes. I will exchange them for airmail envelopes salvaged from airplane crashes. Let me know what you have and what you need.—F., A. Costanzo, Box 32, Punxsutawney, Pa.

TYPEWRITERS

TYPEWRITER WANTED in good working order. Have a wonderful Keystone moving picture projector to trade and several other fine things. State what you have.—Richard Lewis, 49 Ardmore Ave., Providence, R. I.

SMITH PREMIER TYPEWRITER, Chevrolet transmission, Cleveland single complete with Bosch magneto and carbureter, model airplane supplies and plans. Four hives of bees. Will swap for motorwheel, gasoline washing machine engine or what have you?—Bob Gagnon, Route 1, Box 76, Buena Park, Calif.

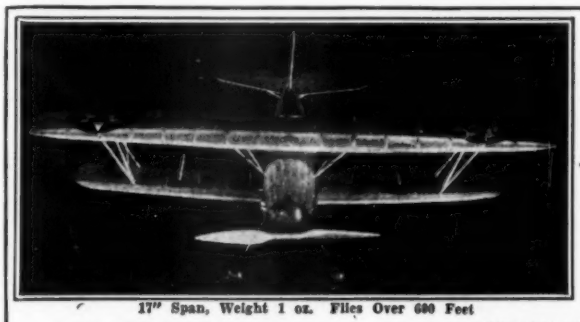
TYPEWRITER WANTED. Any make in good condition of recent date, 48 or more characters on the keyboard. Will give in exchange, flying model airplane, 33 inch span, Daisy 350 shot air gun, Gilbert No. 7 Erector Set, with electric motor, 5 tube battery radio, phones and speaker, Size 10 clamp ice skates, adventure books and air stories, driver golf club, Keystone movie projector, several hundred feet of film and attachment for motor. Will trade all.—Stanley Drzewucki, Jr., 3008 Kossuth Ave., St. Louis, Mo.

TYPEWRITER WANTED, will trade a 15 vol. LaSalle Law Course, or a candy course.—Jimmie W. Holdes, Rt. A, Lamesa, Texas.

END.

. . FROM TAKE-OFF TO LANDING . .
—The Best That Money Can Buy—
$1 Combination, gold finish lapel wing emblem and gold embossed pilot log book, both $1. $2 combination. White Jean cloth helmet lined with same material, free "Kapok" ear pads, leatherette log book wing emblem for the lapel and Rand McNally Air Trails map all for the sum of $2.
Avoid C.O.D. Charges—Send M. O. or Cash
SMOOKLER, Dept.P-3,489, Fifth Ave. (42nd) N. Y. C.

Mill Importers of
MODEL AIRPLANE
JAPANESE TISSUE
PAPER
MADE IN 32 COLORS
WOOD VENEER
WHITFIELD PAPER
WORKS, INC.
16 Vestry St., New York City
Est. 1869


17" Span, Weight 1 oz. Flies Over 600 Feet

CURTISS HAWK P6E

A finely detailed model of the 200 M.P.H. P6E Pursuit, with finished balsa wheelpants, aluminum pilot's seat, hollow aluminum exhaust pipes, balloon type aluminum wheels, detail drawing, insignias, dope, glue, all materials. One of the most beautiful smaller models. Const. Set Post-Paid $1.50.

NEW CURTISS XP934 PURSUIT

18" Span, Weight 1 oz. Flies 675 Feet.
An exact model of the Army's new 250 m.p.h. Pursuit, with finished balsa wheelpants, glistening metal exhaust pipes, aluminum wheels, insignias, detail drawing and all materials. Const. Set $1.25 P. P.

GEE BEE SUPER SPORTSTER

12" Span, Weight 1 oz., Flies 200 Feet
296 m.p.h. Racer 1932 with drawing, special wheels and all materials to make as shown. Const. Set $0.75 P. P.

New 1933 Illustrated Catalogue—10c

MINIATURE AIRCRAFT CORP. 83 LOW TERRACE NEW BRIGHTON, New York

A STONE'S THROW FROM EVERYWHERE

But please don't put it to the test. You won't have to. You're close to everything—and yet on the edge where it's not too noisy. Try it next time••ask for our "Business Special."

(1) Room with bath
(2) Hearty Breakfast
(3) Delicious Dinner
all for $3.50.

Write for information on your firm stationery or identify yourself when you register and say "Business Special."

HOTEL WELLINGTON
55TH ST. AND 7TH AVE.
NEW YORK CITY

"A KNOTT HOTEL"

Lieut. Stenseth

(*Continued from page* 282)

the bird on my tail. Down below was the other plane; its pilot had overshot in his first dive on me. I forgot everything else but that plane. I nosed down in a terrific power dive.

"I must have been going down better than two hundred and fifty miles per hour. I came closer. The German pulled out of his dive. I was diving entirely too fast for what I did then. I pulled the stick all the way back in one fierce pull. I nearly went through the bottom of my seat from the force of my plane's sudden change in direction. I didn't know at the moment that under the terrific strain the flying wires holding the wings had buckled and my wings were in danger of being pulled off at any moment.

"I banked steeply to shake him off my tail. As he went past me I went down on him. I opened up again with only one gun and kept firing until I saw my tracers making mince meat out of his tail assembly.

"It was an easy matter to dress my ship then and let the bullets run along the fuselage like mice after cheese. I got the pilot in my sights; killed him instantly, I guess. His ship rolled and the wings of the Fokker flashed in the sunlight as the plane turned over on its back and down it went.

"I mixed with the second one and after a brief go of it he slipped off. I think I got him, also, but in a fight you're here now, and either you or the enemy is gone the next moment. A pilot can't always be positive he got a plane or if the enemy merely withdrew from too hot a spot. I was sure of the one and let it go at that. I didn't make any claims for the second one.

"It wasn't until I got back to 28's field that I discovered that my wings were just barely hanging on. Another stiff strain and it would have been all over for me. The wind would have torn them off. That taught me a lesson. I came as close to the Pearly Gates as I ever want to come for a long time.

LIEUTENANT STENSETH saw plenty of action with the squadron, whose insignia was similar to the Lafayette Escadrille's "Whooping Indian" excepting the aquiline profile of the Indian head faced the left and the feathered headdress consisted of a single feather. On the St. Mihiel salient he received his baptism of fire and at the Argonne-Meuse, during both the first and second offensives when Squadron 28 made 128 patrols and bombing raids into German territory.

He was in most of the flights when not grounded by a Hisso that developed spells of temperament and failed to function properly. Stenseth, a first lieutenant, fought in the majority of the squadron's 29 official combats and won his share of the outfit's 15 official victories. His officially confirmed victories are listed as six. How many more enemy planes he shot down he hasn't the slightest idea.

For the three days of that historic battle, Sept. 12, 13 and 14, in which brief time the Germans were pushed back, Lieutenant Stenseth flew almost more hours than he had at training fields. Beginning at dawn on Sept. 12th, when the four hour artillery cannonading commenced he, as well as every pilot of the squadron, was on the alert, flying on special missions, seeking out inquisitive German pilots and shooting them down or forcing them to make a hasty and undignified retreat. It was a grilling hectic baptism of fire for Stenseth and he came through without a scratch.

"Balloons?" replied Lieutenant Stenseth in response to my inquiry. "Sure I went down on them, but I never got one that I know of. The reason? Well, I hated the incendiary bullets. It was outlawed you know. The bird that used incendiaries I considered some thirty-two degrees lower than a coward. I dived on 'sausages' a lot and let them have tracers and lead. But it usually took the incendiary to burn them. It was luck when a tracer set a bag afire.

"COMING home after a patrol we always looked for something to try out our marksmanship. Balloons were great fun. They gave us a chance to warm our Vickers up and see if everything was working okay. I used to open up half a mile away just to watch the Heinies get apoplexy winching their bags down. Besides this form of recreation and target practice kept the enemy observers on the jump and seriously interrupted their work.

"Sure, the Krauts blazed away at me with anties, machine guns and everything they had, but it was great sport. I guess they just couldn't find the bullet with my name on it. I was never wounded."

That gives you a pretty good picture of the tall slender lad, Mart Stenseth from Heiberg, Minnesota. He thought it great to go shooting down on a balloon, risking the chance of being shot down, even when he knew he couldn't burn the bag.

Stenseth's biggest thrill was when he came tearing down the battle-ways to save the life of an unknown Spad

AERONAUTICAL ENGINEERING

B·S·Degree in 2 years

For ambitious earnest students—the Tri-State College course in Aeronautical Engineering, 108 weeks. Bachelor of Science degree. Graduates in Mechanical Engineering can complete aeronautical course in 2 terms (24 weeks). Thorough training in all fundamental engineering subjects. Non-essentials eliminated. Courses designed to save student time and money. Flying school facilities available at nearby airports. Enter September, January, March, June. Courses are offered also in Civil, Electrical, Mechanical, Chemical Engineering, Business Administration and Accounting. Living costs and tuition low. Those who lack high school may make up work. Students from 48 states of the Union and 45 foreign countries. Graduates successful.

753 College Ave. Angola, Ind.

Properly trained engineers in design, research, manufacture and sales work are in demand

TRI-STATE COLLEGE

pilot who was being attacked by three overly persistent Fokkers and was in serious danger of being forced down.

With a "pardon my Vickers' lead," Stenseth dived down on the Fokker that was riding the tail of the unhappy American pilot. He watched his tracers burn the German out of the fight. He won't say that he shot the man down, but he does know that he simply vanished from out of the sky.

THE thrill came after the sortie when he saw the pilot waving an acknowledgement of his thanks. The thrill didn't come from the excitement of a tough fight, or that his engine failed to function properly, or that he himself came as close to a flag-draped coffin as he ever wants to come. His happiness was a deep sense of accomplishment of helping a comrade out of a situation that for a while seemed certain death.

Stenseth took a dive on the second Hun and was amazed to find the path ahead free of any enemy planes. Then, looking overhead, he understood a few things he hadn't been told about—a pilot's life and sudden death. German planes were riding *his* tail!

It was then that Stenseth put everything he had on stick and rudder and gave the Hisso the sauce. He showed the Germans how a Minnesota lad could fly and fight. He had fought six times their number and had come out of it without a scratch.

These three, pilots from the best *staffel* the Germans had on that Front, didn't impress him even if he was in their trap. He ripped one Fokker to ribbons. Only after he had driven the other away did he return with his plane shot to ribbons and ready for the junk pile.

But this narrow escape never dampened Stenseth's ardor for going to the aid of distressed Allied pilots. The reports of 28 show that he constantly left formation only to turn up at a spot in the war-torn skies where his brand of swift fighting and hot lead was most needed. His squadron commander wrote into his reports:

"Lieutenant Stenseth seems to be a bear for punishment."

On one of these occasions, Mart met with one of his most bitter disappointments. After leaving a formation to go to the rescue of one of his patrol and saving him, he saw him crash to his death in an accident when landing. That was on Oct. 27th.

The first patrol was led by Stenseth. Over Landies with the enemy anti-aircraft banging away at the American formation, Mart sighted 10 Fokkers. He wagged his wings and led his flight into a terrific dog-fight. During the struggle, Stenseth saw Lieutenant Allain going down with a conked motor. A Fokker was riding his tail. Instantly the patrol leader dived down and forced the Fokker to go to a safer place.

Although Stenseth had saved Lieutenant Allain's life, the pilot was doomed. He brought his ship in for a dead-stick landing at an airdrome at Clarmont. He didn't have sufficient speed to clear the buildings and the strong wind forced him down on the roof of a hangar. And Stenseth, hovering overhead like a guardian angel, saw the man, whose life he had saved, go crashing to his death.

ONE day the following order was posted in the operations office of Squadron 28:

The entire group will hold all available planes loaded with bombs on alert after 7:00 ready to take off within 10 minutes after this order is received.

Now on Sept. 12, 1918, a large patrol of twenty Spad planes soared into enemy territory. There was nothing unusual in the number. But there was something unusual that pursuit planes, which usually crossed the lines at an altitude well over 5,000 feet, were flying at the dangerously low height of only 50 meters. It was the first bombing raid made by Squadron 28.

Stenseth was one of the pilots, who it is believed, were the *first American pursuit airmen* assigned to the additional work of bombing and who carried bombs over positions held by the enemy. It was a new and not altogether pleasant experience for Stenseth. Trained to fly a Spad at high altitudes for pursuit work he found the extra weight of bombs was noticeable in the handling of his plane.

It was impossible to maneuver with the lightning speed to which he was accustomed. Acrobatics were impossible. The low altitude, which put the American pilots at the mercy of diving Fokkers, was fraught with other dangerous hazards—rifle and machine gun fire from troops on the ground.

From then on bombing became a regular special duty of Aero Squadron 28. Day after day Lieutenant Stenseth led patrols far into Germany to bomb everything worth bombing. One of the most dangerous missions he ever flew was to bomb machine gun troops in the trenches near Remonville.

Shortly after that, Lieutenant Sten-

(*Continued on next page*)

ANY OLD GOGGLE
Regardless of condition
ALLOWS YOU A DISCOUNT
ONE DOLLAR
On
ANY NEW GOGGLE

$1.95

AMERICAN MAJOR

—ALL RESISTAL NON SHATTERABLE—

D. E. M.	Wide Vision,	Rubber Mask	$6.50
D. E. V.	" "	Sponge bound	6.00
D. E. K.	" "	Chenille bound	5.50
D. E. C.	" "	Triple Silk bound	6.00
N. N. R.	Transport Goggle		5.50
N. A. K.	Single Chenille		4.00

Avoid C.O.D. Charges—Send Cash or M. O.

SMOOKLER Dept. P-5, 489 5th Ave. New York City

Another Unusual CLEVELAND DESIGNED "Supplies Kit" Offer!

FREE! FULL SIZE SCALE DRAWINGS with each gripping issue of "Cleveland Modelmaking News."

Thousands have already subscribed. Every issue includes airplane, shipmodel, railroad drawings etc., etc. 6-issue subscription $1. A 12-issue (same address) $1.75. (Foreign: add 5c extra per issue). Single copies 25c. All subscriptions begin with First Issue. No unauthentic model be without. Don't miss a single issue. Subscribe TODAY—NOW.

This authentic 3/4" scale Boeing exceeds, we believe, anything yet offered. It may be built and photographed in nearly nine different ways. What a model! The materials kit includes Aeroplane Cement, Silk, Dope, Wheels, etc., are given free with Second Issue of CLEVELAND MODELMAKING NEWS. See below (left) for subscription rates or price per copy.

BOEING F4B-3

Embodies some brand new Cleveland-Designed features. A beauty in looks and flights. Not for beginners. 3/4" scale. Span 25". Length 15 3/4". Complete Kit N-4 (with Colored silver, yellow, red cut drawings) only.... **$1.40**

Lockheed Vega. Span 30 3/4". Kit SF-24.. $2.75

Boeing P-26. Span 21 1/4". Kit SF-23 ..... $1.95

Polish Fighter. Span 25 1/4". Kit SF-6.... $2.50

MONOCOUPE

Nothing ever before so authentic in a flying Monocoupe model. Beautiful performer; easy to build. Span 25". length 15 3/4". Complete material to also build ISP-2 Clident Complete Kit N-3 (with cut drawings) only.... **$1.40**

If your dealer can't supply you, order direct.

CLEVELAND MODEL & SUPPLY CO., INC., 1866-PAE West 57th St., Cleveland, Ohio, U.S.A.

FREE! ILLUST. PRICE LIST NO. 11 showing 47 Authentic "C-D" Kits, and full line of quality Cleveland Diamond Parts & Supplies at

DEEP CUT PRICES!

Don't miss the big savings now available to all Quality modelers. Historic making values. If you haven't a copy of our Price List No. 11—send for it at once. Also see last issue of POPULAR AVIATION.

ALL DEALERS! "A NEW DEAL" TO FORD TO MISS. WIRE OR WRITE! "DEALER CAN AP-

If Your Dealer Can't Supply You—

Use This Coupon

CLEVELAND MODEL & SUPPLY CO., Inc., 1866-PAE West 57th St., Cleveland, Ohio, U.S.A.

Enclosed is $..... for which please rush items on attached list (or written on margin).

( ) Sample copy of First Issue "CLEVELAND PRACTICAL MODELMAKING NEWS" (includes drawings of '32 Gee-Bee and Heath)—25c.

( ) Copy of Issue No. 2 (with F4B-3 and Monocoupe drawings) 25c

( ) Subscription for (including first issue) $1.

( ) Subscription for twelve issues (including 1st issue—and to same address (Canadian and Foreign Orders for U. S. MONEY & P. H. add 5c extra per issue ordered.)

Name .....

Address .....

City and State .....

Build This

NEW BOAT

in 3 days at home with our

COMPLETE KIT $11.75

(all parts cut-to-fit)

The 18-lb. nonsinkable MEAD KI-YAK is the most sensational boat development in years! You can lift it with two fingers; you can carry it on your bicycle; it rides big breakers like a Hawaiian surf-board; it will carry you in 3 inches of water.

FAST LIGHT SEAWORTHY

THE SNAPPIEST THING AFLOAT!

FREE! An 8 ft. double-bladed spruce paddle with the first Kit shipped to each town. Worth $6.00. WE HAVE A REAL MONEY-MAKING PROPOSITION for wide-awake boys. Send dime TODAY for complete information and descriptive circulars.

MEAD GLIDERS

Dept. E-53, 12 S. Market St., Chicago, Ill.

12" Ornamental Models

Photograph of the Hawk P-6-E Model

AT LAST. A striking, true scale reproduction of the famous CURTISS HAWK P-6-E and GEE BEE SUPER SPORTSTER at a price that you can afford. Each an art piece of rare beauty and distinction.

AMAZINGLY large and most complete CONSTRUCTION KITS to build these beautiful models for pleasure or profit are now available at the following SPECIAL PRICES: Curtiss Hawk P-6-E 12" Kit, only $1.70 each. Gee Bee S. E. 12" Kit, only $1.80 each. Postage 20c per kit extra. Please remit by Money Order or Check. Stamps not accepted.

Satisfaction Guaranteed or Money Refunded

RUSH 5c for new illustrated descriptive folder and prices of 12" and 20" Finished Models, Kits, and Drawings. Actual photographs only 10c each.

VICTOR STANZEL

High Grade Model Aircraft

SCHULENBURG TEXAS

NEW! DELUXE HEATH CENTER WING

with Flashy Aluminum Wheels

ONLY **85c** POSTPAID . . . with 10c Catalog FREE

Every customer says Red Birds are the biggest value in the whole industry! Newer designs. More complete kits. Full scale blue-prints. Lowest prices. And, so easy to build! This sensational new Center-Wing is worth Double the Price! Full 19⅝ inch wing span. Weighs ⅞ oz. Makes a great prize-winning flyer, perfectly balanced for distant flights. Extra large, attractive kit contains all wood parts—and then some! New flashy aluminum wheels, 2 celluloid cylinders. Cut-out propeller blank. Colored tissue for red fuselage and white wings, tail. Tube of glue. Large bottle genuine aircraft dope. All wire parts. FULL SCALE BLUE-PRINT! Be sure to get this one!

FREE! With each kit you get free copy of new 1933 Red Bird book, 10c value. Or—send 10c. coin or stamps, for book and get 2 pairs beautiful 3-color insignias, free. Learn how you can earn a Red Bird kit FREE. Mail order for kit or book—TODAY!

Great big 24-inch perfect-scale model of Army Boeing Fighter! One of greatest Red Bird sellers. A joy to build—a thriller to fly! 65-piece kit is a wonder! Buddy Hagan, Ills., writes, "My Boeing P-12E is a beauty. Loops, dives, spins and comes to a 3-point landing." Specially reduced price. . . . . $2.25 Postpaid

Red Bird Model Airplane & Supply Co.

1918 Emmet St. Omaha, Nebr.

seth won two victories in one dog-fight on Sept. 28th. The patrol had crossed the lines at La Harazee on a bombing mission. Near St. Juvin, at 2,500 meters, it ran into eight Fokkers. Although their ships were heavily ladened with the weight of the bombs, the Americans immediately gave battle.

Stenseth released his bombs. Then he tore at the two nearest Fokkers. He kept his machine guns going without a stop. With a long burst of about 40 shots he saw one Fokker withdraw. He rolled and went after the second. Another series of bursts of 40 more rounds, with only eighty rounds of ammunition, he won his two victories. Stenseth saw both his opponents fall through the clouds, then he climbed and waited for the formation to reassemble.

* * *

ALL during the big Argonne push in October and through the rain and fog of November until the armistice, Stenseth ran up one victory after another. Many of the planes he forced down were never officially confirmed—he didn't even ask for confirmation. He was too busy keeping his wheezing motor in shape, urging the riggers to patch up his riddled plane so he could make extra patrols. He flew at least three, frequently four patrols a day and there are records to show that he made five flights in a single day.

Oct. 29, 1918, was a busy day for Mart. He got two more this day. During the second patrol, a protection flight of six ships, he became separated from the formation and attached himself to two other Spads. The Yanks gave combat to three Fokkers.

Stenseth piqued on one ship northeast of Verdun and followed it down to see it crash on the ground. This victory was confirmed without a request. During the third patrol he dropped on a single Fokker and forced it down.

"That 'Kraut' could fly," said Lieutenant Stenseth. "He led me all over the sky. I had to use about two hundred rounds. Then I couldn't get in a fatal burst. So I had to show him I could fly better than he could. I forced him down in our territory near Consenveye."

I asked Lieutenant Stenseth to give the details of his experience in the biggest bombing raid he ever took part in.

"That twenty ship patrol at St. Mihiel was one of the largest," he replied. "But I got the thrill of my life when we went over the lines in November on a special mission to wipe the Germans out of Stenay. There were fourteen planes in our first patrol. We arrived at nine-thirty and laid our first batch of eggs.

"Turning, I led the patrol back over our objective and slipped down through the clouds. I saw several fires and we let go the remainder of our bombs. We started back at nine-forty-five.

"While my motor was idled down to assure a better aim at my target I had a queer feeling that all was not as it should be. A strong disturbing feeling that planes were hovering up in the clouds over my head—a pilot's seventh sense I guess you'd call it.

"Immediately I signalled and we went up into the clouds. I didn't want to take a chance that the Boches had gotten a squadron over to attack us. Firing my guns to warn our boys as I climbed, I was ready for anything. Anything but what I ran into.

"Just picture me all set to do battle to the first and nearest and you can imagine my feelings. I found myself in the center of twenty-four planes. I grabbed my machine gun trips and was ready for action. Then I noticed the red, white and blue *cocarde* of American planes. Well, did I feel foolish! Don't ask me!

"That came close to being a prize boner for me. For in another moment I would have begun firing at them. So to make myself out a regular fellow I hung around and protected this other flight of bombers while they did their stuff. There must have been fire in my eyes, or else I was restless for a good scrap. But it didn't get me anywhere. We didn't spot a single enemy ship during that patrol."

His six official victories and the fact that he was never once wounded bespeaks his courage and skill in the air—not to mention his Distinguished Service Cross and the bronze stars on his campaign ribbon. He pulled many a buddy out of a tight spot in the air and, equally, as capably took care of himself.

Perhaps, because he received many a terrific salvo of enemy fire and proved his sterling qualities, explains why he is still in the military service of the United States. He's a man's man, a fighter and a great soldier. He dreamed as a boy of being a soldier, and he has attained that distinction unquestionably.

END.

XUM

Air Hostess

(*Continued from page 292*)

crew, one more cog in this intricate efficient system.

Inside, the cabin of the ship is not unlike a Pullman car in miniature. Two rows of adjustable reclining seats are divided by a narrow aisle, which leads through a door into the express compartment and gives access to the pilot's quarters in the bow. There is a reading lamp and ventilator above each seat; ash trays and convenient paper containers are near at hand. In the rear, there is a lavatory with hot and cold water and the ship's galley from which the meals are served.

"We have regular mealtimes just as they do on boats and trains. We serve soup, salads, sandwiches, fresh fruit and cake. And of course all the coffee or chocolate the customers care to drink. We used to carry our beverages in thermos bottles, but we have found that it is more satisfactory to carry hot water and make them fresh as they are needed. I take on a fresh supply of hot water at each stop, so I am sure of always having plenty of piping hot drinks."

"Isn't it considered wise to eat rather lightly before you start on a trip?" I asked, thinking of my first long air journey several years ago in Germany, "I don't remember what I had for lunch that day—it may have been the German idea of a light lunch—but I do know it wasn't a wise choice!"

MARTHA grinned appreciatively. "No," she said, "I don't agree with you. I think one should eat rather well, rich and greasy foods are taboo of course, but cereals, broiled steak, fruits and vegetables are all right. In fact, if I know that I am in for a rough trip, I eat a good substantial breakfast—a bowl of oatmeal, etc., something that will stick to the ribs when the ship begins to roll."

As she talked, Martha had, with quick deft motions, put the cabin into ship-shape order. Seats were covered, safety belts in order, the blankets—neatly folded—and fresh pillows were stowed away in racks overhead. New time-tables and airway maps were tucked into convenient little pockets on the back of seats, reading lamps and ventilators were adjusted and one quick glance in the galley assured her that the needed supplies were aboard. The great motors were warming-up now, and it would be only a few minutes until this luxurious—this incredible ship of the skies would be up and away.

(*Concluded on page 338*)

Introducing Pastel Colored Helmets

Red—Orange—Green—Blue—O. D. & White Custom Tailored Washable With Goggle Straps, Chin Buckle and Special Sewn in "Kapok" Ear Pads. Match the Color of Your Plane, Cabin or Costume. Goggles, illustrated, $4.50 non-shatterable. Combination Helmet & Goggles, $4.95. Mention size of Helmet.

$1

Avoid C.O.D. Charges—Send Cash or M. O.

SMOOKLER, DEPT. P-4, 489 Fifth Ave., New York

BOEING STUDENTS GO BEHIND THE SCENES

to learn about Air Lines

DAY in and day out, the multi-motored planes of United Air Lines, the world's largest air-transport system, are arriving at the Oakland Airport, home of the Boeing School, on regular air-mail and passenger schedules.

Each detail in their construction, servicing and operation is studied by Boeing students. The 50,000,000 miles of practical flying experience which United alone has had are actually the background against which Boeing training is built.

And in addition to this, the Boeing School offers other observation posts "behind the scenes".

The research and manufacturing methods of such industrial leaders as Stearman, Sikorsky, Chance Vought, Hamilton, Pratt & Whitney, and the Boeing Airplane Company are taught, here, to the flyers and mechanics of tomorrow.

United Aircraft & Transport Corporation maintains no other flying school, but back of Boeing training it places the resources and active guidance of a nationwide air-transport and manufacturing organization. The standards that have brought the United group of companies to commercial leadership are the *only* standards taught by Boeing School.

Why not make your own comparison? Mail the coupon for a copy of the new Bulletin, giving enrollment requirements, courses, costs and living conditions at the Airport.

THE REDUCED PRICES APPLY ON *ALL* FLYING COURSES
Next regular enrollment, July 3

BOEING

SCHOOL OF AERONAUTICS

Subsidiary of United Aircraft & Transport Corp.

BOEING SCHOOL OF AERONAUTICS
Room R-5, Airport, Oakland, California

Gentlemen: I am interested in

☐ Boeing Master Pilot
☐ Boeing Master Mechanic
☐ Transport Pilot
☐ Special Master Pilot (*Open to holders of Transport Licenses*)
☐ Limited Commercial Pilot
☐ Private Pilot

Name_____ Age_____

Address_____

City_____ State_____

Advertise in this Directory. Rates: $2.00 per insertion.

BUYER'S DIRECTORY

One-Inch Advertisements. No more — no less.

AIRPLANES FOR SALE

Corben Sport Planes

"CORBEN BABY ACE"
Snappy single place sport plane
"CORBEN JUNIOR ACE"
Two-place convertible sport plane

Both are now offered flyaway or in semi-built kits for the home builder. Send dime for illustrated folder.

CORBEN SPORT PLANE CO.
Madison Airport — Madison, Wis.

REAL-PLANE-BARGAIN

Safe, stable, Lincoln PT 2 place biplane. OX5 Engine, Hartzell prop, 18 x 6.00 low pressure tires. Licensed till June, 1933. Also extra OX5 rebuilt and about 85% complete. Extra set New 26 x 4 wheels, tires and discs. Entire ship in 1st class shape. Never crashed. Orange wings, blue fuselage. Complete outfit $425.00. Photo 15c.

J. B. DAHL
3861 Archer Ave. — Chicago, Ill.

USED AIRPLANES $85 AND UP

Also two factory built Gliders.
Free Flying Instructions. Cars taken in trade. Sensational Bargains. Send 10c for literature.

FEDERAL EQUIPMENT CO.
Dept. 11 — Deer Park, Ohio

AEROPLANE OFFER

Will accept late model automobile as part payment on Challenger Robin, Challenger Commandaire, Wasp Bellanca, Wasp Buhl, Challenger Fledgling or $250.00 cash will buy complete set Curtiss Robin parts good condition motor and prop included.

MARVIN NORTHROP AEROPLANE CO.,
MINNEAPOLIS, MINN.

FOR SALE

Identified Heath Super Parasol with Henderson motor. Welded fuselage. Complete with instruments and skis. Total time one hour. In perfect flying condition. Will sacrifice for cash. Best offer takes it.

L. D. PIERCE
Box 123 — Plymouth, N. H.

FOR SALE

Light biplane with welded fuselage, 15' span. Less motor, wheels, and one lower wing cover. A wonderful buy at.....$75.00
One converted Harley 74 motor with prop $16.00
One pair new 18 x 3 wire wheels, tires and tubes.....$20.00
One 40 h.p. twin opposed motor, complete, $150

Alfred Roth
1616 Burlington St. — Chicago, Illinois

FOR SALE

Two place Alexander Flyabout cabin monoplane. 45 h. p. Szekely motor, practically new, only 47 hours time. Ship and motor in perfect condition, just recovered and relicensed. Will sacrifice for cash.

A. E. THOMPSON
Lakota, N. Dak.

AIRPLANE PARTS

Color dopes, any color $1.00 gallon. 1/16" and 3/32" Birch plywood sheets 13 sq. ft. $1.50. 26 x 3 wire wheels 50c. 26 x 4, $1.50. 30 x 5, $2.50. New Altimeters 4" dial, 28000 ft. $1.95. New Jaeger tachometers 2400 R.P.M. $1.95.

AIR TRANSPORT EQUIPMENT INC.
Garden City, N. Y.

FOR SALE

1 Schaefer Glider Motor complete with mount, magneto ignition, weight complete 33 lb.

Price $75.50

50 ft. new 5/8" shock absorber cord $5.00

Walter A. Dunbar
R.F.D. No. 1, Cambridge, N. Y.

TURNBUCKLES

I have about 1000 Brand New U. S. Army Specification Turnbuckles that I must sell at ONCE. They are all one size & suitable for Lightplanes. FORK-BARREL-EYE, 2 in. Barrel at ONLY 3 cents each.

I will mail C.O.D., if you send cash with order please enclose enough for postage, 12 turnbuckles weigh 16 ounces. They will go fast so send in your Order at once NOW! Don't wait and be disappointed.

CHARLES J. LACKEY
1143 Cherry St. — Pottstown, Penna.

Zenith O-20000 Foot Altimeter

postpaid U. S. and Canada

$2.75

Marvin Northrop Aeroplane Co.
Minneapolis, Minn.

FOR SALE

New High compression aluminum cylinder heads FORD model A cheap.

Ford model A propeller Pietenpol aeroplane $15.00 fit Turnbuckles, $1.00 wheels, $3.00 tachometers, Air wheels cheap. 3c enclosed will secure full list of buys.

Marvin Northrop Aeroplane Co.
Minneapolis, Minn.

DON'T BUY anything until you get Ort's 1933 Aviation Material Catalogue. Prices are lower. Send one thin dime today.

Karl Ort
670 W. Popular St. — York, Pa.

AIRCRAFT SPRUCE

Spruce and Plywood
by piece or carload
Wood parts for standard glider designs furnished

Spruce Products Company
1555 Railroad Ave. — Seattle, Wash.

SPECIAL BARGAINS

on small aircooled engines, air propellers and hubs for lightplanes, wind wagons, boats, sleds, scooters and home workshop uses. Single and twin cyl. Indians, Hedstroms and Harleys with sprocket or air propeller ready to run. Ford conversion blueprints $2. Airplane wheels 26 x 4, $4 pair. Four cyl. magnetos, $4 each. 1/4" and 3/32" flexible cable cheap. Turnbuckles 10c each. Altimeter $3. Bargain list 10c.

Storms Aviation Co., Asheville, N. C.

AIRPLANE PROPELLERS

IMPROVED PROPELLERS

For quick service, order from this ad, cash with order.
4-ft. diameter for Harley and Indian Motors $4.50
4-ft. 6 in. for Heath Henderson metal tipped $8.98
6-ft. for Fords, Lawrence and Anzani metal tipped $9.98
8-ft. for the O. X. 5, laminated Oak, Copper tips $19.95
New Heath Ship, $248.00; 40 H. P. Aeronautical Motors $75.00. New 1933 planes, fly away, $398.00
Photos; information including leather bound flying manual 25c

HIBBS, Fort Worth, Texas

PROPELLERS

Designed for boats, sleds, and planes. State your particular need. Other equipment as Planes (flying at present) A-1 condition. Motors A-1 condition. New hubs for automobile motors.

The J. B. S. Propeller
LITITZ, PA.

PROPELLERS

Designed and built for
Racing Planes, Sportplanes, Windwagons, Windtunnels, Hydrogliders, Ice, and Snowsleds.
New low prices on all Special Propellers. Send 3 cent stamp for circular.

LORENZEN PROPELLERS
Dept. P.A. — Niles, Mich.

FOR LIGHT PLANES

Guaranteed Propellers
4'6" diameter for Heath B4—$8.50
Aluminum alloy wheels and Pontoons

KERMIT R. TROYER
75 Mt. Vernon, Grand Rapids, Mich.

AUTOS

BUILD A FRONT DRIVE!

The details of construction of a Dual Baby Front Wheel Drive Auto as this are now in blueprint and available to you. This car powered by a 4-cyl. motor is made of old car parts as Model T, etc. all so cheaply obtained now, and best of all a machine shop is not a necessity for making such a fast one. Send stamp for further details.

Edw. A. Borntranger, 3450 N. Marshfield Ave., Chicago, Ill.

BUILD

This midget car complete for only $17.85! Carries two passengers. 80" long, 30" wide. Lightning pickup and speed, 3hp. engine 200 mp. g. gas. Anyone can build it in a few hours; no special tools' Simple, reliable, efficient and ridiculously low priced. We supply parts.

$1.00 brings simplified full size assembly blueprints. Instructions, 11 construction photos and price lists. Credit on parts order. Send today!

BUG MIDGET AUTO CO. — Kearney, Nebr.

GLIDERS

GLIDER FOR SALE
$45.00 F.O.B.

Northrop Primary Glider. License No. 152Y, perfect shape, flown only five times, always hangared, equipped with trip release tow hook and shock absorbing wing skids. Price includes crating. BLUEPRINTS. 30" x 35" three view prints of Boeing P12B—$.25. Three sheets 30" x 35" of Fokker Triplane, complete—$.35.

Damian - McFarland
448 Harrison Ave., Greenville, Ohio

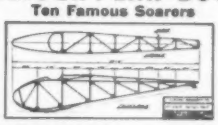
Soar This Summer

You can easily build your own soarer at low cost. Start NOW and you can fly this summer. We will RUSH complete factory layouts and large scale, detailed plans for a well known UTILITY GLIDER on THREE DAYS FREE APPROVAL. If you keep them, send us $1.85, our bargain price.—Just send 15c postage and tell us to RUSH UTILITY PLANS.

VIKING AIRCRAFT CO.
HAMILTON, OHIO

The GLIDER PLAN-BOOK of Ten Famous Soarers

Complete; Blueprints, Specifications, Flight Performance.



BIG BARGAIN Only 45c. Order Now. HURRY!!!

VIKING AIRCRAFT CO., — Hamilton, O.

XUM

Advertise in this Directory. Rates: $2.00 per insertion.

BUYER'S DIRECTORY

One-Inch Advertisements. No more — no less.

INSTRUCTION

PILOTS LICENSE EXAMINATIONS MADE E-Z

Booklet of 200 typical exam questions with correct answers, includes 1932 changes in Rules and Regulations, Aerodynamics, Engines, Ignition, Navigation and Meteorology. Covers all grades Pilots and Mechanics written exams. Send one dollar today. Booklet of Safety Flying Rules. 125 Don'ts, with reasons on twenty primary flight maneuvers. Price 50c.

E-Z AVIATION SYSTEM
Box 6-P, Rosedale, N. Y.

For complete information on the

Free Flying Training

given by the Army Air Corps, send for our bulletin "FLYING WITH THE ARMY." Flying Cadets are paid a salary while learning. Get full information on how to apply for this training. Price 20c postpaid.

FEDERAL EQUIPMENT CO.
Dept. 11 DEER PARK, OHIO

"WANTED—AVIATION CORRESPONDENCE COURSES. Any kind. No objection if soiled or scrawled with notes. MUST BE COMPLETE. Name your price (it must be cheap) in first letter."

La Tour Aeronautical Service
2014 N. Howe St., Chicago, Ill.

We Instruct You to Fly For $10 Per Hour
(DUAL OR SOLO)

It is possible to obtain a Solo Pilot's License for as low as $200. All instruction given on licensed Air-Cooled ships at Nebraska's Largest Airport. Write for further information to

Sidles Airways Corp. Union Airport
Lincoln, Nebraska

MODEL AIRPLANES (Ready Built)

Solid and Flying Models

Finished Scale Models Complete with Wire Riggings, Insignias and MOVABLE CONTROLS.
9½" (U. S.) Boeing Bomber.....$2.25
10" (U. S.) Condor Bomber.....$2.25
READY BUILT Model that is Guaranteed to fly. 15" Eaglet, R. O. G. Model.....$1.50

CHRISTIE BATLAS
P. O. Box 149 Morgantown, W. Va.

FLYING MODELS BUILT TO ORDER

Send stamps for price of model you want; also price list of models on hand. Models from Pioneer kits a specialty.

Expert Propeller Carving Done

Ardin L. Johnson
226 N. Pine Ave. Chicago, Ill.

Solid Scale Model

The following 7 in. wing span models for only 75c P. P.

Every plane is complete in all details, such as motor parts, rigging wires and insignia. Finished in Bi-Colors.

Spad	Fokker D-7	Ansaldo
Curtiss Mail	Travelair Curtiss JN4B	Sikorsky Amph.
Waco	Lockheed Exp.	Boeing 204

Kuehne Brothers, 326 Wood St., Sistersville, W. Va.

FINISHED NON-FLYING SOLID SCALE MODELS OF MODERN SHIPS READY BUILT

2 in. Boeing P-12C.....$ .50
4 in. Boeing P-12C.....$ .75
4 in. Curtiss P6E.....$ .75
4 in. Vaught Corsair.....$ .75

and other models large and small like the Waco-Bird—Laird—Gee Bee and others. Send dime for complete price list. Ships are from 1½" to 18" from 35c to $5.50.

VITO MARCHINO, JR.
15140 Turlington Ave., Harvey, Ill.

FINISHED SCALE MODELS

Order any scale model you wish and enclose $1.00 plus postage. Wingspread 4 in. to 6½ in. Fine wood construction, glossy lacquered finish. Enclose 25c east of Mississippi, 40c west of Mississippi, 40c Canadian and foreign charge. No C. O. D. orders. Larger scale models also made to order. All inquiries answered on special model aviation projects.

MUELLER BROS., 28 Peach St., Buffalo, N. Y.

MODEL KITS AND PLANS

Texaco Sky Chief

12" Exact Scale Model of Lt. Commander Frank Hawk's New Speed Ship. Each Kit comes complete with a 14" Hangar.

Price $1.00 Post Paid

Aero Accessories Co.
2196 Gravesend Ave., Brooklyn, N. Y.

MONEY BACK IF YOU CAN BETTER THESE VALUES!!

20" Boeing P12C.....$1.25 P.P.
20" Bellanca Skyrocket.....$1.00 P.P.

These kits have plans and instructions that can be understood, ribs, formers, struts printed clearly on smooth balsa, all strips, 2 oz. dope in Boeing and 1 oz. cement, 1 oz. dope and 1 oz. cement in Bellanca. Finished cowling, paper, pins, sandpaper, insignia, blanked prop, balsa wheels, etc.

AMERICAN MODEL AIRCRAFT COMPANY
102-02 Liberty Ave., Ozone Park, L. I., N. Y.

Here is value that is value: Solid Scale Models 6-8" Boeing P12C, P6E Hawk, Fairchild 24, Howard Racer, Nieuport, Travelair. Kits contain the following: Every part of the model is stamped on Balsa, including the body, struts, balsa doughnut wheels, bearings, pins, insignia, sand paper, full size plans and directions, cement, 2 bottles of colored dope, aluminum propeller and drag ring. Each kit complete only 30c P. P. Send 3c stamp for price list. Send for yours NOW.

AMERICAN MODEL AIRCRAFT CO.
102-02 Liberty Avenue Ozone Park, L. I.

500 Ft. Flights Guaranteed

65c BUYS THE MOST COMPLETE KIT ON THE MARKET TODAY. Over 20" wingspan—HEATH PARASOL and COMMANDER. You don't have to spend one cent extra. A contest winner that can be made by a beginner. Kits Post Paid.

American Model Aircraft Co.
102-02 Liberty Ave., Ozone Park, L. I., N. Y.
Dealers and Clubs Write for Prices

A Great German Fighter

The Halberstadt C. L. 2

A 22¼" FLYING SCALE MODEL

This month we are featuring this well detailed model in the most complete kit on the market. Parts stamped and semi-formed. A model in which flyability is designed.....$2.00 P. P.

Black Hawk
2851 Vincennes St. Pittsburgh, Pa.

At Last, Bent Bamboo Parts Included In Kits At No Extra Cost

C. G. ATTACK—17" Gull wing, rubber driven model. (The famous Carlson Gull model) Construction set, containing bent tail and wing tips only.....75c

Send 10c for plan of 12" Laird Super Solution and Illustrated Folder.

Carlson Model Airplane Co. Dept. D-2
134 S. CLINTON ST. CHICAGO, ILL.

HEATH PARASOL COMMANDER **50c** EACH

Biggest 50c kit value ever offered or ever will be to the model builder. Balsa parts accurately printed, dope, cement, plans, etc. Nothing else needed.

Add 10c EACH KIT FOR POSTAGE

CONSTRUCT-A-PLANE CO.
285 BUSHWICK AVENUE BROOKLYN N. Y.

R. O. G. —14" all balsa parts cut to shape. Takes off, flies, banks, loops and glides. **25c** EACH

ALL BALSA REPLICA MODELS

NIEUPORT	6⅝"
HOWARD RACER	6"
BOEING P-12C	7½"
CURTISS HAWK P-6E	7½"
MYSTERY "S" RACER	7"
FAIRCHILD "24"	7"

Add 5c EACH KIT FOR POSTAGE

CONSTRUCT-A-PLANE CO.
285 BUSHWICK AVENUE BROOKLYN, N. Y.

20" FLYING BELLANCA SKYROCKET

An unbeatable kit. Printed balsa parts, turned balsa finished nose piece, turned balsa balloon shaped wheels. Dope, cement, instructions, etc. **85c** Add 10c for postage

20" FLYING BOEING P-12C

Complete with machine turned balsa cowl and printed motor balsa ribs and formers. Full size plans and a liberal supply of everything. **$1.10** Add 10c for postage

CONSTRUCT-A-PLANE CO.
285 BUSHWICK AVENUE BROOKLYN, N. Y.

PUSS MOTH KIT

Genuine Guaranteed Crescent parts and accessories complete. Exact Replica of model exhibited at Dyker Park Model contest. Flies 1500 ft. Beat record made by Crescent's Flying Glory model. Complete only $1.50 Post paid. Catalogue 5c.

Crescent Model Aircraft
1805 Benson Ave., Brooklyn, New York

24" Cabinaire Monoplane

CRESCENT parts. SIMPLE construction. Flies 1000 ft. Exhibited at Dyker Park model contest. Wonderful value for big ship model. Complete kit with Guarantee only $1. WRITE TODAY. Catalogue 5c.

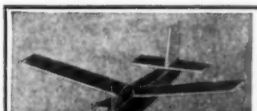
Crescent Model Aircraft
1805 Benson Avenue, Brooklyn, N. Y.

Latest Crescent Model!

20" wing span. Real size model with record flight 1000 to 1500 ft. easily. Wings adjustable. Balsa and finished propeller with complete accessories by Crescent. A Real Crescent value. Supply limited. Dealers, schools, clubs write for complete details.

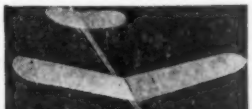
Price only 50c. Catalogue 5c.
WRITE NOW

CRESCENT MODEL AIRCRAFT
1805 Benson Avenue, N. Y.



CABIN PLANE JR.
Flying Model Complete Kit Plus 3c postage **15c** (Stamps)

G. H. Q.
625 Jackson Ave.
New York, N. Y.



BABY ENDURANCE PUSHER
Complete Kit sent Postpaid (Stamps) **30c**
2 to 4 min. flights

G. H. Q.
625 Jackson Ave.
New York, N. Y.

FOKKER TRIMOTOR
Flying Model
Complete Kit sent Postpaid (Stamps) **75c**

G. H. Q.
625 Jackson Ave.
New York, N. Y.

(Continued on next page)

Advertise in this Directory. Rates: $2.00 per insertion.

BUYER'S DIRECTORY

One-Inch Advertisements. No more — no less.

MODEL KITS AND PLANS

2 Ft. Bowlus Glider

A 24" tapered wing model of the famous Bowlus soarer. All Balsa construction with demountable wings. Can be adjusted for 30 ft. diam. loops, turns, and soaring flights. Has a gliding angle of 15 to 1. Can be assembled in ½ hr. after receiving. The kit is semi-constructed.

Plans and kit for 24" plane, postpaid in U.S.A. .50c

GOLDEN ARROW MODEL AIRPLANES
53 Vinewood Avenue Pontiac, Mich.

MODEL AIRPLANE PLANS

Authentic ¾" flying scale. FOKKER D XVII high speed military pursuit biplane used by the Dutch Air Service. Wing span 24". BEECHCRAFT 17R commercial biplane using negative stagger. Wing span 26". Northrup Gamma, Frank Hawks low wing ship. Wing span 36". All parts clearly shown full size on plans. PRICE 50c each. No stamps or foreign coin.

HUNTINGTON MODEL AIRCRAFT CO.
P. O. Box 5044 Huntington, W. Va.

FULL SIZE PLANS

with instructions of 3 to 8 ft.
UNUSUAL type Flying Models.
Designed by Prof. T. N. de Bobrovsky
Send 3c stamps for complete list

A. L. JONES
51 Greenleaf Ave., W. N. Brighton, N. Y.

My Business is Good ● ● ● ● ● ● ● ● and Here is the Reason

VALUE

7 inch SOLID SCALE model plans. All guaranteed exact. Three good offers in price.
10c EACH.. Six for 50c.. Or Twelve for 90c
All POSTPAID.....NO STAMPS PLEASE
Albatross, Spad, Fokker D7, Camel, Boeing P12C, Helldiver, Akron Fighter, Monocoupe 110, Gee-Bee New, Fairchild "24", Wedell Williams, Laird.

E.L. LONEY 2909 Collingwood Detroit, Mich.

STRAIGHT UP WITHOUT STALLING!

That's just ONE of the MANY unusual maneuvers a "SPEED DEMON" can perform. Its perfect stability is the result of its unconventional but scientific design. Get YOUR "Speed Demon" NOW! Build it! Fly it! Then you'll KNOW why they say "DURAND designed models FLY!" Very complete kit. $1.00 p. p.

MIDWEST MODEL AIRPLANES & SUPPLIES
S. E. Corner 50th & Miami Sts. Omaha, Nebr.

24 Inch U. S. MARINE FALCON

Flying scale model. All parts clearly stamped on balsa.

Complete with full size plans and instructions

25 POST PAID

Remit by Ck or M. O. Send 3c stamp for price list

HUB MODEL AIRPLANE & SUPPLY CO.
475 Brook Av., Bronx, N. Y. (Dept. P)

24" New Fokker Hospital Ship

Flying scale models. All parts clearly stamped on balsa completes with full size plan and instructions.

25 POST PAID

Remit by Ck. or M. O. Send 3c stp. for list

HUB MODEL AIRPLANE & SUPPLY CO.
475 Brook Av., Bronx, N. Y. (Dept. P)

FLYING MODELS

FOKKER D7
GEE BEE
PRINTED PTS.
BALSA WHEELS

75c
10c Postage

BOEING F4B4
CURTISS HAWK
FULL SIZE PLAN
CEMENT, WIRE, ETC.

THE MODEL SHOP
321—67th St. Glendale, L. I.

FORD TRI-MOTOR TRANSPORT PLANE

Solid Scale Model—14" Wing Span

$2.00 Complete Kit Postpaid

N. Y. Model Airplane Co.
4016 Church Ave. Dept. P Brooklyn, N. Y.

Sea Gull Model Kits

16" Cabin Commercial—Flights 1000 ft. Flown as either high wing and low wing model. Complete Kit with all material for both models.....75c
19" Single Pusher Duration 2½ min.....50c
19" Bullet Twin Pusher Duration 3 min.....65c
20" All Balsa Soaring Glider.....30c
10c Packing and Postage Charge on all Kits

Sea Gull Model Aero Co.
87-10 Rockaway Blvd., Rockaway Beach, L. I., N. Y.

Scientific's Famous 15" FLYING SCALE MODELS

Lockheed Vega, Fokker Triplane, S.P.A.D. Chasteur (illustrated), S.E. 5 British Pursuit. Easy to build. Guaranteed to fly. All 4 Kits sent postpaid for $2.00.

55c EACH plus 5c postage for each kit.

SCIENTIFIC MODEL AIRPLANE CO., 277 Halsey St. Dept.P., Newark, N.J.

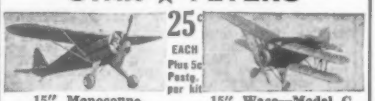
STAR ★ FLYERS

25c EACH Plus 5c Postg. per kit

15" Aeronca C-2 15" Fokker DVII

True Scale Models—Guaranteed to Fly
STAR MODEL AERO SHOP, 10 Pearl St. Newark, N.J.

STAR ★ FLYERS

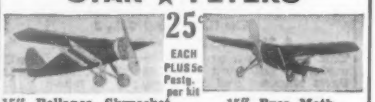


25c EACH Plus 5c Postg. per kit

15" Monocoupe 15" Waco—Model C

Perfect Scale Models—Guaranteed to Fly
STAR MODEL AERO SHOP, 10 Pearl St. Newark, N.J.

STAR ★ FLYERS



25c EACH PLUS 5c Postg. per kit

15" Bellanca Skyrocket 15" Puss Moth

Every Kit Complete—Guaranteed to Fly
STAR MODEL AERO SHOP, 10 Pearl St. Newark, N.J.

BOYS—BUILD 2 WARTIME PLANES

for the price of one. Our Supply Kit contains more than enough Balsa sheets, sticks, cement, plans, etc., to build 2—15" Wartime or Modern planes sent insured and postpaid for only $1.00. HERE'S VALUE—Red Wing model airplane plans of the Curtiss Robin, Hawk, Vought Corsair, Page Racer, Lockheed Vega, etc. Regular 30c seller only 10c each. 3 for 25c. SPECIAL—17" R. O. G. plans printed on JAP Tissue. Each 3c.

SWALLOW MODEL AIRCRAFT
3840 N. Newland Ave., Chicago, Ill.

BOYS! THE PHANTOM!

A white streak climbing through the air a beautiful low wing ship gliding to a landing. The Swallow "Phantom." Boys—this plane has flown over 850 feet and is the niftiest looking plane you ever have seen. Just think! So simple to build that in about three hours after the postman brings you your "Phantom" you will be flying it. Wing span 16¾ in. Order now—sent postpaid only 50c.

SWALLOW MODEL AIRCRAFT
3840 N. Newland Ave., Chicago, Ill.

DIFFERENT FUSELAGE MODELS
THE SKYLARK

16 in. Span, 12 in. body, open cockpit high wing. The most complete kit on the market. A real flier, easily built, fine for beginners. COMPLETE KIT —$1.00 Postpaid. Semi finished kit for Fleetster or Skylark, each 50 cents—postpaid. Semi finished Hornet D-2 Pursuit kit—65c p. p. MONEY ORDERS ONLY. Our illustrated catalog of easily built models, honest value parts and supplies—3 cent stamp.

THAYDOM MODEL AIRCRAFT CO., Atlantic, Penna.

MODEL AIRPLANE BLUEPRINTS

Curtiss Army Hawk P1	13" span	15c
Fairchild "24"	13" span	15c
Fairchild "22"	13" span	15c
Boeing P-12-F	15" span	15c
Great Lakes Trainer 2-T-1	15" span	20c
Kari-Keen Coupe	24" span	35c

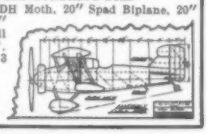
Send 3c postage for complete list and dealers' discounts.

UNITED PLAN CO.
4807 Capitol Ave. Omaha, Nebraska

NEW PLANS—BARGAIN PRICES

FULL SIZE-EVERY PIECE DETAILED- ACCURATE WONDERFUL FLYERS-HUNDREDS SOLD

24" Lockheed Orion, 24" DH Moth, 20" Spad Biplane, 20" Wedell Williams Racer, 30" Army Hawk, 30" Curtiss Hell Diver, 18" Nieuport "28", 20" Fokker DVII. 25c ea. 3 for 60c. RUSH ! ! !



Viking Aircraft Co.
Dept. 25
Hamilton, Ohio

FREE

Plans for a flying model of the

HEATH BABY BULLET

if you send for our Free price list. Send postcard with name and address. Kits for above model, 15c postpaid. Flies 100ft. easily. 55 ft., 3/64 rubber. 9c; ¾" wheels, 2c each.

WOBURN MODEL AIRPLANE SHOP
(Dept. P-S), 17 Belmont St., Woburn, Mass.

The New Sensation In Flying

Be the first in your locality to build and fly the "Kiddie Kopter." Complete kit sent postpaid on receipt of 50c. Send check or money order.

THE YANKEE PROPELLER CO.
19 Park St. Dover, N. H.

MODEL AIRPLANE SUPPLIES

MODEL AIRPLANE SUPPLIES

Send your name and address for a sample of Balsa Wood and our prices on model airplane supplies.

Aero Shop, 3050 Hurlbut Ave. Detroit, Mich.

"IT'S A WOW!"
"Materials the Best Ever!"

So say hundreds of boys about our popular "O-3 Supply Kit.' So many agree that they must be right. Get yours now and see for yourself. Price only 25c postpaid. Or send 3c stamp for price list.

AircO Models & Supplies
2193 Alter Road Detroit, Mich.

A NEW POWER

FOR MODEL PLANES OF 3 TO 8 FT. WINGSPAN and Model Racing Boats. Our NEW Featherweight Steam Generator and Radial Steam Engine gives you longer duration, more power and less weight. Send 3c stamp for descriptive circular B9 and prices for Construction Kits or Ready to Run Plants.

R. A. BROOKS
4020 Lake St., Chicago

XUM

Advertise in this Directory. Rates: $2.00 per insertion.

BUYER'S DIRECTORY

One-Inch Advertisements. No more — no less.

MODEL AIRPLANE SUPPLIES

GASOLINE MODEL AIRPLANES
75" Wing Span, wt. 2.5 lbs.

These models really fly with the Knight one cylinder motor and have a remarkable performance. SEND 10c for illustrated folder and also plans for 12" Laird Super Solution.

Carlson Model Airplane Co. **Dept. D-1**
134 S. CLINTON ST. CHICAGO, ILL.

See POWER MODEL BOAT & AIRPLANE CO. ad for motors to suit these airplanes.

Trailing Edges

Biggest invention in model airplane history!!! Saves money, time, and labor. Gives a perfect trailing edge. Absolutely Guaranteed. Use for wings, tails, and etc. This cutter and one for 1/16", 3/32", 1/8", 1/4" for 30c postpaid. Boys, rush your order for this latest sensation.

DETROIT MODEL SHOP
1966 W. Davison Detroit, Mich.

A Real 1/8 h.p. Gasoline Engine

in miniature, for MODEL AIRPLANES and boats. ¾ in. Bore ¾ in. Stroke—weight 1 lb.—3200 R.P.M. GET CATALOGUE, REAL BOATS, MOTORS—FITTINGS, ETC.—only 20c (coin). LOUIS P. LOUTREL,
96 McDonough St., Brooklyn, N. Y.

QUALITY SUPPLIES!

4" tube colorless cement	5c	Rubber	
3 oz. can clear dope	11c	.045, 1/16 sq., 3/32 flat,	
3 oz. can colored dope	14c	1/8 flat.....3 ft.	1c
Tissue, wh. or red, 5 for	10c	Dope Brushes	
Bushings, per dozen.	3c	3 for.....12c	
Bamboo, 1/16 sq., 1 dz.	3c	Wire, all sizes, 10 ft.	3c

All supplies Guaranteed. No orders under 25c Add 10c postage. No checks or stamps. Send 3c for price list.
MODEL AIRPLANE UTILITY CO., (Dept. P-5)
1140—53rd St. Brooklyn, N. Y.

A NEW TRANSMISSION

This new GEARLESS device doubles the endurance and increases the performance of flying models. Two separate strands of rubber run the same propeller. It may be glued to motor stick or fuselage. Directions included.

The whole transmission weighs only 1/40 ounce but will fly models up to 1½ ounces in weight. Retail price, 40c postpaid. Post card brings circular of this and other types of transmissions. Dealers write for discounts.

MODEL AIRPLANE MOTORS
2322 Stuart St., Berkeley, California

World's Lowest Prices

18" length balsa

1/16x1/16	31.5c	3/8x1/2x5	10.5c
1/16x1/8	26 5c	1/2x3/4x6	8..5c
1/8x1/8	25...5c	5/8x1x7	4....5c
1/8x1/4	13...5c	3/4x1½x10	2.5c
3/16x3/8	8...5c	1x1½x12	1..5c
1/4x1/4	10...5c	1/32x2	8.....10c

1/16x2	8....10c
1/8x2	6....10c
3/16x2	4....10c
1/4x2	3....10c
1x2	1.....10c
2x6	1.....35c

Add 15c for postage Send 3c for price list.
DETROIT MODEL SHOP
1966 W. Davison Detroit, Mich.

QUALITY SCOOP QUALITY

Clear Cement 2 oz., 9c; Banana oil, Acetone, Dope, ea. 2 oz. 7c; Colored dope 2 oz., 10c; Thrust bearings 1. or s., 10c per doz.; Washers 2 doz. 3c; Wheels-wooden balloon-¾D., 1"D., per pr. 3c, 1¾, 1½"D. per pr. 4c; Jap tissue-colored or white, 2c per sheet; MRL Brown Rubber 1/30" th., 1/32" 50 ft., 7c, 3/64" 50 ft., 9c, 1/16" 50 ft., 12c, 3/32" 50 ft., 13c, 1/8" 50 ft., 13c; Alum. cowl 1½" D., 20c.
Add 15c for postage.....Send 3c for price list.
DETROIT MODEL SHOP, 1966 W. Davison, Detroit, Mich.

Model Dealers and Clubs!

A 3c stamp will bring you our new wholesale list that will mean greater profits for you.

Larger discounts on smaller quantities!
Act at Once!
MODEL AIRPLANE UTILITY CO. (Dept.P-5D)
1140-53rd. St. BROOKLYN, N. Y.

BALSA BARGAINS

SHEETS—18" LENGTHS

1/32 x 2.....8 for 10c	1/8 x 2.....6 for 10c
1/16 x 2.....8 for 10c	1/4 x 2.....3 for 10c

Strips—18" Lengths

1/16 sq.	30 for 5c	3/8 x ½	5..8 for 5c
1/16 x 1/8	26 for 5c	½ x ¾	6..7 for 5c
1/8 sq.	22 for 5c	¾ x 1	8..3 for 5c
1/8 x 1/4	11 for 5c	¾ x 1¼	10..1 for 3c

Prop. Blocks

All supplies guaranteed. No orders under 25c
Add 10c postage on all orders. No checks or stamps.
MODEL AIRPLANE UTILITY CO. (Dept.,P-5)
1140—53rd St. Brooklyn, N. Y.

NATIONAL'S NEW 1933 48-page catalogue "F"

the "MODEL AIRPLANE BUILDER"
Containing valuable tips to model builders, complete listing of new exclusive quality supplies at lower prices, a storehouse of important data and topped off with a 12" 3-view genuine blueprint. Every model builder should have this necessary reference book. Send today. Only **10c**
NATIONAL MODEL AIRCRAFT & SUPPLY CO.
Bluebird Bldg. (Dept. X-5), New Rochelle, N. Y.

MODEL MANUFACTURERS! DEALERS! CLUBS!

SEND FOR **FREE SAMPLE**
Tube of CLEAR CEMENT

Packed in gross cartons. State quantities you will most likely be interested in. (Make request on your business letterhead.)

UNIVERSAL MODEL AIRPLANES, INC.,
4016 "P" Church Ave., Brooklyn, N. Y.

GASOLINE MOTORS

for Model Airplanes and Boats

1 & 2 cylinders—⅞" Bore, ¾" Stroke, 3000 R. P. M. Weight 1 cylinder motor about 7 ounces. Send 10c for full particulars including sectional view drawing of 1 cylinder motor.

See Carlson Model Airplane Co. ad for planes to suit these motors.

POWER MODEL BOAT & AIRPLANE CO.
134 So. Clinton St. Chicago, Ill.

New Book Free!

New "Airplane Models" book free with Red Bird kits. See page 332. Or, send 10c, coin or stamps, for book and get 2 pairs 3-color insignias free. Get ready for spring model-building. Many splendid new designs. Complete supplies. Lowest prices. SEND NOW!

RED BIRD MODEL AIRPLANE & SUPPLY CO.
1929 Emmet St., Omaha, Nebr.

SUPPLIES AT LOWEST CUT PRICES
PRICE LIST FREE

AA Balsa 36" lengths		Clear Cement 2 oz.	.12
1/16 x 1/16	14 for .05	Rubber .045 18 ft.	.05
1/16 x 1/8	13 for .05	Tissue, 3 shts.	.05
1/8 x 1/8	10 for .05	Wire .020, .034, 5 ft.	.02
1/32 x 2	each.....03½	Wheels, ea., 1" .03; 1¾"	.04
1/16 x 2	each.....04	24"Spad or Falcon Kit.	.65pp
1/8 x 2	each.....05	12" U S Hawk Kit	.45 pp

Add 10c Postage
Success Model Airplane & Supply Co.
1846 W 34 Place, Dept. P.A. B, Chicago, Illinois

BALSA WOOD

Special for Model Builders

100 Pieces, 12 Sizes, 1/16" square to ½" x 1". All 18" long, smooth cut, and good quality. Just what the model builder needs. A Real Bargain.
Postpaid, 50c
Send 3c in stamps for complete catalogue, kits and supplies, also general information of interest to all model builders.
SWIFT AIR MODEL SUPPLIES
363 Brittain Road, Akron, Ohio

PHOTOGRAPHS

WARTIME PLANES

For sale: Hundreds of sharp, clear, actual photographs of pioneer, wartime, and modern airplanes. All 7½ x 9½ inches in size. Send for free list and please mention Popular Aviation.

R. R. MARTIN
1615 N. Western Ave. Hollywood, Calif.

MISCELLANEOUS

UNPATENTED IDEAS CAN BE SOLD

I tell you how and help you make the sale. Free particulars. (Copyrighted)
WRITE W. T. GREENE
927 Barrister Bldg. Washington, D. C.

Jig Saw Puzzle Pictures

20 PICTURES BY WORLD FAMOUS ARTISTS $1.00 P.P.
20 Pcs. of 3-Ply Wood to fit same $1.00
Both $2.00 in U. S.
PIONEER WOOD CRAFT
4911 Cornelia Ave. Chicago, Ill.

For Every Flyer
BLIND FLIGHT
IN THEORY AND PRACTICE
By Maj. Wm. C. Ocker & Lt. Carl J. Crane
America's Foremost Instructors
Only complete work thoroughly covering the subject. Permanent cloth bound book over 200 pages, 114 illustrations. Price $3.00. 5 day Money-Back guarantee. Order from Your Dealer or Write
Naylor Printing Co., 918 N. St. Mary's, San Antonio, Texas

PATENTS—TRADE-MARKS

Terms reasonable. Personal attention.
Send model or drawing for FREE advice.
Book "HOW TO GET YOUR PATENT" sent on request
L. F. RANDOLPH
REGISTERED PATENT LAWYER
372 Victor Bldg. WASHINGTON, D. C.

STUNT FLYING

By CAPTAIN DUNCAN

Every trick of the stunt flyer explained in this fascinating book. Loops, barrel roll, whip roll, Immelman, split-S, falling leaf, tail slide, upward spin, upside down flying. Profusely illustrated. $2.50. Send for it now.
FRED C. BUSE
683 East 138th St. New York

Electrical Bargains

Special bargains in Alternating and Direct Current Generators. Also some used. ½ Horse Repulsion Induction Alternating Motors $12.75. Write for quotation on the machine you need.
Electrical Surplus Co.
Dept. 44, 1885 Milwaukee Ave., Chicago

Want a Job in Aviation?

You don't need to be a Pilot. Hundreds of other jobs in the growing Air Transport field. Start at the bottom and work up. Our booklet "Wings of Commerce" tells of hundreds of jobs, salaries paid and how to qualify. Also lists leading Air Transport Companies in Canada, U. S., Mexico, Central and South America. All the information you need.
Price 20c postpaid.
FEDERAL EQUIPMENT CO.
Dept. 11 DEER PARK, OHIO

Partner wanted for new invention of great merit. New type commercial carrier will operate in air, on water or on land. Safe, fast and cheap—will revolutionize transportation.

P. J. HOLMES
1500 S. 3rd Ave. Maywood, Ill.

BUYER'S DIRECTORY

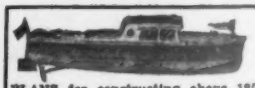
One-Inch Advertisements
Rates: $2.00 per insertion

MISCELLANEOUS

WANTED ! !

Any make small 1 cylinder aircooled engines. Describe fully, stating bore, stroke, condition and horsepower. Send clear snapshot if possible. Must be cheap. Will consider anything usable. MONEY MAILED AT ONCE.

P. O. BOX 529, KEARNEY, NEBR.



BUILD A MODEL POWER BOAT

PLANS for constructing above 18" CRUISER Model with display of power plants..... 35c
PLANS for a 15" "V" Bottom SPEEDBOAT with display of power plants..... 25c
DISPLAY sheet of power plants only (Spring and Electric Motors)..... 3c
SEATTLE MODEL BOAT CO. Dept. C, P.O. Box 233 Seattle, Wash.

CLASSIFIED

QUALITY PRINTING. Exceptionally low prices. Print Anything. National, Syracuse, Indiana.

MAKE MONEY applying Initials, Monograms on Automobiles, Suitcases, etc. Quick easy profits. No experience needed. Free Samples. "RALCO," 1084 Washington, Boston, Mass.

BUILD YOUR OWN BOAT, using Brooks (Originators of KNOCK-DOWN System) ready-cut materials and save two-thirds regular builders costs, have more successful seaworthy craft. Frames fully assembled. Cruisers, Runabouts, Launches, Outboard Motor, Row and Sail, including Rudders Snipe Class Sailer. Also complete assortment Propellers, Shafting and Accessories. Send 10c for catalog. BROOKS BOAT CO., Inc. Box V-39, Saginaw West Side, Mich.

PATENT Your Invention—"Little Ideas May Have Big Commercial Possibilities." Send for free book. How to Obtain a Patent and Record of Invention Blank." Prompt service. Highest references. Reasonable charges. Deferred payments. Established 1898. Victor J. Evans & Co., 790 Victor Building, Washington, D. C.

MOTION PICTURE Bargains. News reels $2.25, odd reels $1.50. Bargain lists. Hoffman Film Service, 57 Broad, Albany, N. Y.

Hostess

(*Continued from page* 333)

"I am given a list of the passengers," she continued as the ship taxied up to the Terminal, "and I have to see that they are all in their seats and the safety belts fastened before it is time to leave. We ask the passengers not to smoke during the take-off, but as soon as we are in the air, I remove the 'No smoking' sign which has been hanging over the crew's nameplates. This draws attention to our names and acts as an introduction.

"As I collect the tickets, I try to see that each person is comfortable. I adjust ventilators, heaters and lights; I furnish magazines and newspapers if they care to read, matches for those who smoke, or pillows and blankets if they want to sleep. If there are bridge fans, I bring out the cards and improvise a table, and if they need an extra player I sit in on the game.

"It is all great fun and it never grows tiresome. Each trip is different. We carry a lot of interesting people. The movie stars use the airlines all the time."

It had been a cold grey day and even the mighty ship quivered when the fierce blasts sweeping across the field lashed against the hangars and eddied across the tarmac.

"You are in for a rough trip tonight," one of the mechanics yelled above the noise of the wind and the engines.

"What of it?" laughed the girl as the door slammed shut and the engines roared open. The great liner, like some fat-bellied bird, lumbered off down the runway gaining speed—faster—faster—then suddenly it became buoyant—miraculously light and floated off the ground. And in a few moments, it was only a grey shadow against a greyer sky.

"Yes, what of it!" I thought as I looked across the busy airport. Five years ago this was only a weedy stretch of open prairie—five years hence, what? And in another fifty years, will that great airliner be in a museum as the covered-wagon is today?

END.

SUBSCRIBE TO POPULAR AVIATION
(*See page* 328)

Mono vs. Biplane

(*Continued from page* 280)

training ships and are so used even at the present time for obvious reasons. They are sturdy, comparatively easy for the novice to handle and in other ways most adaptable for training beginners.

And so, in summing up arguments for and against the biplane, we find that it is a most admirable type of ship that cannot justly be condemned simply for the fact that laboratory tests indicate an interference loss in the biplane cell. This loss, as has been pointed out, is more than compensated for by the improvement in other aerodynamic and practical features such as improved aspect ratio, reduced weight, reduced wing stresses and greater stability and ease of handling. The biplane is a strong dependable type of construction that will ultimately return to its former popularity, without a doubt.

END

Aerobatics

(*Continued from page* 296)

will be described later. To do a half-roll, which is really a half-roll and a half-loop, leave your motor throttled, pull your stick straight back; and at the same time kick full rudder in the direction you want to roll. The ship turns over. Now the trick is to take off rudder when you are upside down, so that the ship will come out right side up describing a half-loop.

If you leave your rudder on too long, the ship may go into a spin. If it does, bring it out in the same manner you would a normal spin. You can do a half-roll this way and fly the ship on its back, but it is very hard because you will have to shove the stick plenty far forward when you get upside down. I will describe several other methods of getting a ship upside down in a later article.

If you have a model airplane, it will be very easy for you to take this ship while you are on the ground and place it in the various positions so that you can study out just what happens. If you do this, you will find that it will be much easier to do the maneuvers in the air.

After we have described all the maneuvers that are necessary and that you can do without hanging in the belt, we will go into inverted flying and have the thrill and fun of flying upside down. However, it is very necessary that you master the maneuvers, or stunts, that I am describing first, so that you can do them almost automatically. Practice the stunts as I give them, completely mastering each one as you go, and I would suggest you practice them in the rotation they are given, and save each magazine article until the set is complete for ready reference.

END.

POPULAR AVIATION,
608 S. Dearborn St.,
Chicago, Ill.

See page 301

Gentlemen:

I enclose one dollar ($1.00) herewith for one year's membership dues in the lightplane association now being organized.

NAME.....

STREET OR R. F. D.....

CITY..... STATE.....

XUM